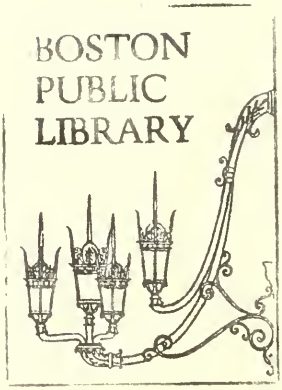
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SUPPLEMENTARY REPORT

NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

SPONSORED BY

BOSTON REDEVELOPMENT AUTHORITY
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FAY, SPOFFORD & THORNDIKE, INC.
WALLACE, FLOYD, ELLENZWEIG, MOORE, INC.

JANUARY 1980

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JANUARY, 1980

FOREWORD

The following report has been prepared as a supplement to previous studies aimed at developing a design scheme for a new Northern Avenue Bridge over the Fort Point Channel. The continuing deterioration of the existing bridge has placed an urgency on the need to resolve the issues that have delayed the further engineering design and construction of a replacement bridge facility.

The preparation of this report has been sponsored by the Boston Redevelopment Authority and the Massachusetts Port Authority. Both agencies are also co-sponsoring the Seaport Access Study to identify improved access, particularly for trucks, to the existing and proposed seaport development in the northern industrial sector of South Boston.

Both agencies recognize the importance of a new Northern Avenue Bridge as an integral part of any seaport access program of improvements and for that reason have sponsored this study in an effort to allow the Northern Avenue Bridge Replacement project to proceed as expeditiously as possible.

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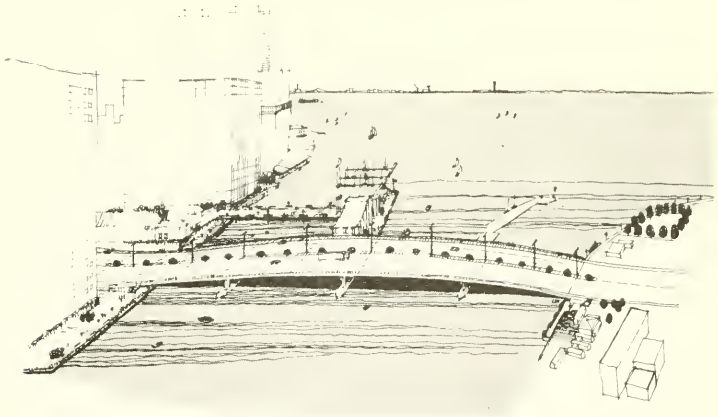
SUMMARY AND CONCLUSIONS

BACKGROUND AND PURPOSE OF REPORT

The existing Northern Avenue Bridge cannot be repaired to extend its usefulness as a street arterial for any significant length of time. A replacement bridge has been under study since 1972. A Negative Declaration for the replacement bridge project was accepted by the Federal Highway Administration (FHWA) in 1974.

This report has been prepared to serve as an update and supplement to the previous bridge replacement planning and environmental studies. It is intended to resolve a number of preliminary design issues which have prevented the initiation of bridge engineering design since the Negative Declaration. The report also serves to document the recommendations of the City of Boston and the Massachusetts Port Authority to the Massachusetts Department of Public Works (MDPW) for a new Northern Avenue Bridge.

Findings and conclusions related to the proposed, approximately $12 million, 630-foot, fixed-span bridge over the Fort Point Channel, as detailed in this report, include the following:



Perspective of new Northern Avenue bridge

STUDY FINDINGS

- U.S. Army Corps of Engineers concerns regarding alignment of the navigation channel in regard to new bridge piers have been resolved by a new 3-pier arrangement of support piers.

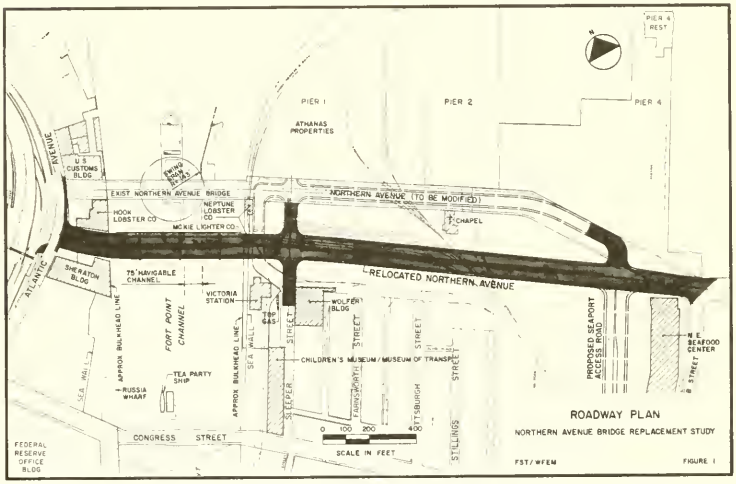
STUDY FINDINGS (Cont.)

- Acceptable design for land approaches to the bridge allow a vertical clearance of 16 feet over Mean High Water (MHW). Alternate roadway profiles that provide 20 or 25 feet of clearance above MHW have serious impacts on traffic operations, adjacent land use and aesthetics. Also, added clearance would only allow a small marginal increase in the types of boats served.

- The majority of current boat traffic now using the channel can be served by the 16-foot clearance. Readily available dredging equipment can clear the fixed span when necessary. Low tide clearance of about 25.5 feet will also be available for some possible special circumstances.

- Fireboat access will no longer be required since a new peripheral fire hydrant system will be constructed along the Channel.

- A movable span for water traffic has been judged as too expensive from a construction, maintenance, and operational cost point-of-view as well as too disruptive of the important vehicular traffic the bridge must serve.



Larger scale copy of this drawing at back of report.

- The new bridge is compatible with land use and urban design concepts as outlined in "Boston Harbor, Challenges and Opportunities for the 1980's". This includes provision of pedestrian ways and re-use of the existing bridge in the open position.

- The alignment of relocated Northern Avenue, east of the Channel, can be shifted slightly to accommodate future adjacent land uses. Existing Northern Avenue in this area will provide local access to surrounding development and may be downgraded.

- The environmental impacts of a new bridge would be generally similar to or lesser than those identified in the 1974 Negative Declaration, which reconfirms its validity.

- The proposed bridge is independent of and compatible with any identified long range plans for the Central Artery or a Third Harbor Crossing.

- The bridge right-of-way will require the relocation of only one business, McKie Lighter Company, and only partial land takings from other properties.

NEXT STEPS

It is intended that the findings of this report be used in discussions with the U.S. Army Corps of Engineers and the U.S. Coast Guard to allow the issuance of a Coast Guard permit for a new bridge. Following issuance of the permit, engineering work should be initiated as soon as possible to allow early bridge construction, due to the poor condition of the existing bridge. Federal and State funding of the bridge replacement is proposed through the Federal Highway Administration (FHWA) and the Massachusetts Department of Public Works (MDPW). This report will, therefore, also serve to meet FHWA and MDPW considerations.

I. INTRODUCTION

Purpose of Report

The purpose of this report is to resolve a number of issues which have stalled the development of plans for a replacement Northern Avenue Bridge. These issues are reviewed and recommendations made for changes in the bridge design as may be necessary and possible. In addition, the report provides a review and update of transportation, land use, environmental and urban design factors relating to the bridge. It is intended that the resolution of these issues will lead directly to the regulatory approvals required for engineering work to proceed, followed by construction of the new bridge. The proposed bridge design, as described in this report, represents the City of Boston's and the Massachusetts Port Authority's recommendation to the MDPW for a new bridge.

The existing Northern Avenue Bridge over the Fort Point Channel, due to its deteriorated condition, urgently needs a replacement facility that will be able to accommodate both existing and anticipated future vehicular traffic destined to and from the northern industrial sector of South Boston. The existing, City-owned Northern Avenue facility has just recently undergone emergency repairs to its foundations to permit its continued functioning as a major roadway link to the Northern Avenue area and South Boston. These emergency repairs are only a stop-gap measure, intended to allow the facility to be kept open to vehicular traffic until a suitable replacement facility can be constructed. The repairs guarantee no definite time span for continued use of the bridge. Moreover, the existing facility is in serious jeopardy of having to be closed in the future.

Proposals for a replacement facility for the existing Northern Avenue Bridge have undergone scrutiny and analysis since 1971, when the Massachusetts Department of Public Works first engaged a consultant to undertake design studies. However, since that time, conflicts regarding proposed designs have arisen among the various sponsoring, funding and permitting agencies.

Both the Boston Redevelopment Authority (BRA) and the Massachusetts Port Authority (Massport) are currently co-sponsoring the Seaport Access Study in South Boston. The purpose of the Seaport Access Study is to develop a program for improved roadway access, particularly for truck traffic destined to and from the existing and proposed industrial and commercial development in the area north of First Street in South Boston. As the initial phase of that study, BRA and Massport asked their consultants, Fay Spofford & Thorndike, Inc. and

Wallace, Floyd, Ellenzweig, Moore, Inc., to attempt to resolve the design conflicts that have delayed the design development, agency approvals, and eventual construction of a Northern Avenue Bridge replacement. The rationale for a replacement bridge facility at Northern Avenue has always been that it is the most basic and necessary roadway improvement of any seaport access road system. Agreement on a design for the replacement facility would allow detailed design studies and construction of a new bridge to commence in the near future, a requirement mandated by the deteriorated condition of the existing bridge.

This report advances a proposal for a Northern Avenue Bridge replacement. The proposed design represents the recommendation of the City of Boston and Massport to the MDPW and responds to the various issues that have delayed construction of the facility to date. Additionally, this report updates the two previous reports prepared for a Northern Avenue Bridge replacement, and provides the supplementary documentation required by federal and state agencies to secure the approvals necessary to advance the project into the final design phase.

This following report has been divided into four sections.

- Section I - INTRODUCTION, documents the purpose of this report, the history of previous Northern Avenue Bridge studies and identifies the major issues that have emerged from the previous studies.

- Section II - PROPOSED NORTHERN AVENUE BRIDGE REPLACEMENT - BASIC DESIGN, textually and graphically presents a proposed design for a replacement facility at Northern Avenue. The proposed design addresses issues that have delayed the design and construction of the bridge and the physical and operational constraints imposed by the site. Design feasibility is assessed with respect to traffic safety, marine safety, aesthetics, land use, regulatory and agency criteria, and cost constraints.

- Section III - RESOLUTION OF DESIGN ISSUES, identifies each of the previously raised issues and discusses the success of the proposed design in accommodating each issue.

- Section IV - ENVIRONMENTAL IMPACTS UPDATE, identifies the potential environmental impacts of the proposed design where they are different from the environmental assessment prepared in 1974 by the MDPW for the previous bridge design.

Throughout this report, reference is made to information contained in the original 1974 report "Replacement of Northern Avenue Bridge and its Approaches over Fort Point Channel, Feasibility Study, Environmental Assessments and Basic Design", and the 1977 supplementary report entitled "Supplementary Report, Scheme C-3 Modified, Replacement of Northern Avenue Bridge and its Approaches over Fort Point Channel", to avoid repetition in this report.

History of Northern Avenue Bridge

The existing Northern Avenue Bridge over the Fort Point Channel is one of four bridges over the Channel connecting South Boston to the downtown core and the regional highway system. It is one of the major links between South Boston's industrial/commercial area north of First Street, and the regional highway network. It affords access to the regional highway network without intrusion on either the Boston CBD or the South Boston residential area. The bridge currently accommodates approximately 17,000 vehicular trips daily, of which approximately 1400 are truck trips. Significant increases in vehicular movements across this vital link are anticipated in the future, as the Boston Marine Industrial Park (BMIP) becomes a major employment center, new port terminals are developed by Massport within BMIP and at Castle Island, the Fish Pier and Fargo Building are rehabilitated, the Army Base is declared surplus by the U.S. General Services Administration (GSA) and becomes occupied for other uses, and currently vacant lands are transformed by various private developers to active residential, commercial and industrial uses.

The existing Northern Avenue Bridge is over 70 years old. It was constructed in 1907 and is owned and maintained by the City of Boston. As a major public thoroughfare, the condition and structural integrity of the bridge are constantly monitored to certify its safety for public use. It was after intensive examinations and evaluations of the bridge in 1970 that a determination was made that the bridge could not realistically be repaired to extend its useful life for a significant length of time. It was evident that the need to begin planning for a replacement bridge was paramount. Consequently, the MDPW interceded to assist the City of Boston in the planning and design for the replacement of the existing Northern Avenue Bridge.

In 1972, Universal Engineering Corporation was engaged by the MDPW to conduct feasibility and basic design studies for a Northern Avenue Bridge replacement. Shortly before that time, emergency repairs were undertaken in 1971 to the existing bridge to extend its life until a replacement facility could be built. Repairs were required in early 1972 to portal truss

members damaged by the accidental opening of a dump truck on the bridge.

In 1974, the report entitled "Replacement of Northern Avenue Bridge and its Approaches over Fort Point Channel, Feasibility Study, Environmental Assessments and Basic Design" was published by Universal Engineering Corporation under contract to the MDPW. The report recommended a fixed-span bridge structure over the Channel, located approximately 200 feet south of the existing bridge, with provision for 15 feet of vertical clearance above Mean High Water (MHW) in the Channel. A Public Hearing held on the bridge replacement study in March of 1974 evidenced strong support for the C-2 alternative, as described in the report. Also in 1974, another round of emergency repairs was required to keep the existing Northern Avenue Bridge in operation. In 1975, the Federal Highway Administration (FHWA) approved the original bridge replacement report and accompanying Negative Declaration which concluded that there would be no major negative environmental impacts resulting from construction of a new bridge. The FHWA said that the bridge replacement was eligible for federal funding provided that all necessary permits were obtained. Application was made at that time for a formal permit from the U.S. Coast Guard for construction of the replacement bridge, since the new bridge would cross navigable waters.

In September of 1976, in response to a query by the Coast Guard, the U.S. Department of the Interior ruled that the existing Northern Avenue Bridge was eligible for inclusion on the National Register of Historic Places as an historic landmark, pursuant to Executive Order 11593. The ruling requires that special studies be conducted to evaluate the historic value of the existing Northern Avenue Bridge before a determination can be made on whether the existing bridge can be demolished, or whether it should be preserved as an historic landmark.

In late 1976, the Coast Guard indicated approval of the proposed bridge replacement pending receipt of permits from other regulatory agencies. In 1977, the Boston Conservation Commission asked that the MDPW modify the replacement bridge design to eliminate the filling of a small portion of Fort Point Channel. The MDPW complied with the request and altered the bridge design to include the placement of four bridge piers in the Channel instead of the previous three piers with embankment-fill proposal. The alignment of the proposed replacement bridge was also shifted slightly south at Atlantic Avenue to avoid the Hook Lobster Company building. At this time, a second report was published by the MDPW entitled "Supplementary Report: Scheme C-3 Modified" outlining the design changes.

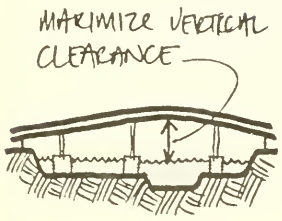
In late 1977, the modified bridge design proposal was resubmitted by the MDPW to the U.S. Coast Guard for permit approval. About the same time, the Mayor of Boston sent a letter to the MDPW stating that the City would retain the existing Northern Avenue Bridge as an historic landmark. During the processing of the Coast Guard permit application, yet another issue arose. The Boston Fire Department indicated that a fixed-span bridge with 15-foot clearance would preclude fireboat access to the Channel south of the new bridge. The issue was resolved through an agreement between the MDPW and the Boston Fire Department to install an improved hydrant system in the area around the Channel, in conjunction with construction of the new bridge. This system would eliminate the need for fireboat access into the Channel.

In October 1978, while the application for a Coast Guard permit was still in process, the U.S. Army Corps of Engineers asked the MDPW to further evaluate the implications of a fixed-span bridge on vertical clearance above the Channel. The Corps also questioned the location of the four proposed bridge piers and how they might affect horizontal clearances in the Channel, now that the existing Northern Avenue Bridge was to remain. A second letter to the BRA in April, 1979 from the U.S. Army Corps of Engineers raised the same issues regarding the effects of the proposed new bridge on navigation in the Channel. Based on the design proposals that had been submitted, the Corps stated that they could not recommend to the Coast Guard that a permit be issued for the bridge design. Subsequently, no permit has been issued by the Coast Guard for the proposed replacement bridge and thus the design of a replacement facility has not proceeded beyond the preliminary study stage.

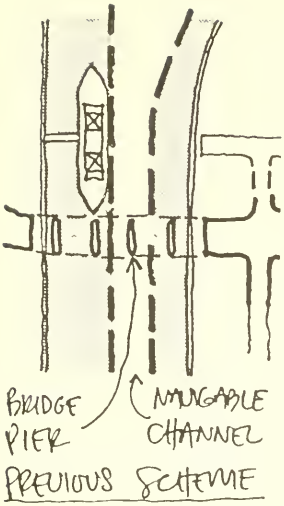
Since April of 1979, no further studies of a Northern Avenue Bridge replacement have occurred until this report. Currently, emergency repairs are once again being made to the existing bridge, with its future lifespan still in serious question.

Major Study Issues

Several major issues are reviewed in this report. First and foremost, is the effect of a new Northern Avenue Bridge on navigation in the Fort Point Channel. Suggestions have been made that the vertical clearance provided by the bridge be increased from 15 feet to 20 or 25 feet above Mean High Water (MHW). Higher clearance would affect roadway grades and the connections of the approach roadway segments on either side of the Channel. The City of Boston maximum roadway gradient is 6 percent. Steeper grades could make the roadway difficult to negotiate by truck traffic under adverse (i.e., slippery) pavement conditions or under heavy loads.



Vertical Clearance over Fort Point Channel



Bridge pier locations-previous bridge proposal

Horizontal clearance for water traffic in the Channel has been a major issue. This issue arose with the decision to retain the existing bridge in place as an historic landmark. A navigation channel 75 feet wide is located to the east of the center foundation. This navigation channel is maintained by the Corps of Engineers, and provides depths in excess of 20 feet for the passage of large vessels. To date, proposals for a bridge replacement have called for four bridge piers in the Channel, with one pier in the channelway defined by the existing bridge. The pier foundation in the channelway is approximately 200 feet downstream of the existing bridge. This pier foundation did not pose any impediment to water traffic in the original designs, since the existing bridge was to be removed. However, with the existing bridge retained, such a pier location would require a vessel to navigate to either side of the new pier as it moves downstream. While such a maneuver is possible, the Corps felt it was an unnecessary impediment to navigation, and asked that the design be reconsidered.

The Corps of Engineers questioned the effect of restricted vertical clearance under the proposed bridge on waterfront-oriented businesses located along the Channel. Several businesses and organizations depend on boat access into the Channel. McKie Lighter Company, a waterfront construction firm, often docks barge mounted cranes, in excess of 60 feet in height above water level, along its docking space on the east side of the Channel. Neptune Lobster Company receives lobster boats for the delivery of fresh fish and shellfish. The Tea Party Ship is moored downstream of Northern Avenue at the Congress Street Bridge. Russia Wharf Company provides docking space for houseboats, motorboats and sailboats at its berth on the west side of the Channel, just north of Congress Street. Lastly, future boating facilities at the Transportation and Children's Museums, as part of the South Station Transportation Center, and as part of a possible future waterfront development plan, have been proposed for the Fort Point Channel.

Other issues that were raised by previous studies or which have recently emerged include:

- Fireboat access;
- Minor shifts of the roadway alignment to mitigate impacts on adjacent land uses;
- Access to adjacent development;
- Pedestrian walkways along the waterfront;
- The relationship of the replacement bridge to the existing Northern Avenue Bridge;

- Land acquisition and business relocation requirements of a new bridge;
- The effects of either a Third Harbor Tunnel or Depressed Central Artery on a new bridge;
- The disposition of the existing segment of Northern Avenue east of the present bridge;
- The compatibility of a new bridge with both existing and proposed adjacent waterfront activities; and
- Bridge aesthetics and visual impact.

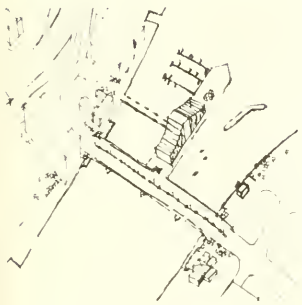
These issues have been addressed in the course of this latest study, and a new bridge design is proposed which resolves many of the problems evident in previous designs. However, many of the issues are interrelated and rather than resolve one problem and exacerbate another, a compromise has been sought. Some of the issues cannot be resolved without violating City of Boston roadway design criteria.

Design Criteria

Certain design criteria were adhered to in developing the proposed design scheme, and are described in the next section. These criteria include the following:

1. The existing Northern Avenue Bridge must be kept in operation during construction of the replacement bridge.

2. The New Northern Avenue Bridge will be a fixed-span structure. Previous studies have concluded that a moveable span bridge is undesirable and costly. A moveable span bridge would cause serious disruptions to traffic flow, including backups onto the Central Artery exit ramp. Since Northern Avenue will be the primary arterial servicing the South Boston industrial and commercial areas, potential bridge openings would have to be severely limited and infrequent. The construction cost of a moveable span bridge, as identified in previous studies, would be double that of a fixed-span bridge facility. Additionally, an annual maintenance cost of $200,000 for bridge tenders would be incurred. Lastly, the increase in boat and vessel traffic that could be serviced by a moveable span versus a fixed span bridge is extremely small. A re-examination of these factors still concludes that a fixed-span bridge is the only feasible option.



Northern Avenue area - aerial view

3. The existing Northern Avenue Bridge will remain and be fixed in an open position. The nature of its restoration will be the subject of a separate study undertaken by others and coordinated with this study. The report entitled "Boston Harbor,

Challenges and Opportunities for the 1980's, has suggested possible conversion of the existing bridge to an historic, marine, recreational facility. The design of the new bridge, however, is not dependent on the re-use of the existing bridge.

4. The Northern Avenue Bridge replacement will connect with Atlantic Avenue at-grade on the west side of the Channel and will connect with Sleeper Street at-grade on the east side of the Channel.

5. The maximum allowable grade for roadways and approaches in the City of Boston is 6 percent.

6. The centerline alignment of the Northern Avenue Bridge replacement is generally defined to fall within the corridor approximately 200 feet south of the existing bridge. Some flexibility does exist, however, to shift the roadway either slightly north or south.

7. The design proposal will be consistent with Boston's overall waterfront development plan as detailed in "Boston Harbor, Challenges and Opportunities for the 1980's", November 1979, by the Boston Redevelopment Authority.

The proposed design for a Northern Avenue Bridge replacement follows in Section II.

II. PROPOSED NORTHERN AVENUE BRIDGE REPLACEMENT - BASIC DESIGN

General

The following section describes the basic design characteristics of the proposed Northern Avenue Bridge replacement. This design proposal is based on a re-examination of the issues that have previously delayed the further design of this project. Discussion of the options considered in arriving at the proposed design shown are included in the section following this design proposal. Reference is made to the 1974 "Replacement of Northern Avenue Bridge and its Approaches, Feasibility Study, Environmental Assessments and Basic Design," and the 1977 "Supplementary Report, Scheme C-3 Modified, Replacement of Northern Avenue Bridge and its Approaches over Fort Point Channel," where information contained in either of those two reports is applicable.

Roadway Layout

The proposed Northern Avenue Bridge replacement and associated roadway relocation will involve approximately 2800 feet of new roadway construction, including construction of a new 630-foot bridge spanning Fort Point Channel, and located approximately 200 feet south of the existing Northern Avenue Bridge. This will allow for the existing bridge to be kept in operation during construction of the new bridge.

As illustrated in Figure 1 below, the proposed relocated Northern Avenue Bridge alignment will connect with Atlantic Avenue on the west between the Sheraton Building and Hook Lobster Company and extend eastward over the Fort Point Channel to a connection with existing Northern Avenue in the vicinity of B Street.

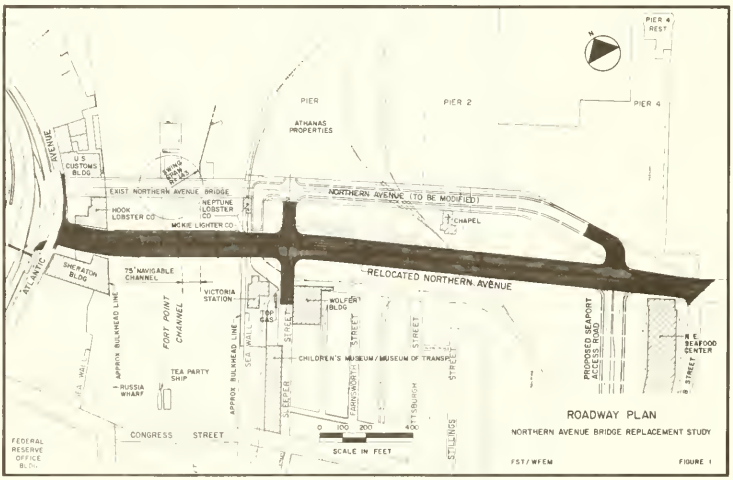


FIGURE 1

The bridge plan and an elevation view of the proposed bridge are depicted in Figure 2. Larger scale drawings of Figures 1 and 2 are located in the back of this report.

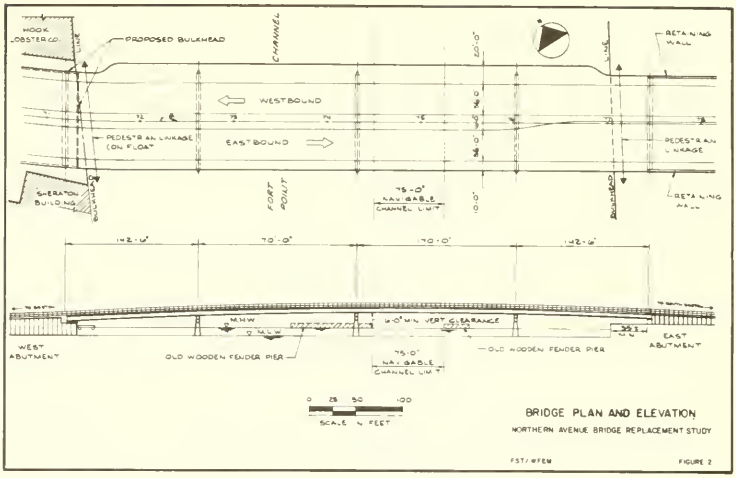
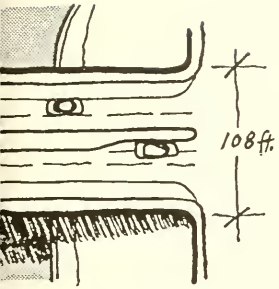
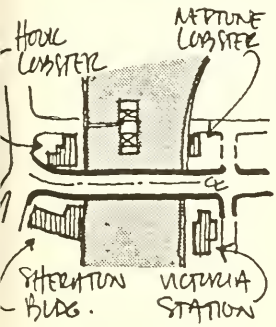


FIGURE 2



108 Foot Right-of-Way



New bridge location

The new roadway will intersect Sleeper Street at grade. A 108-foot right-of-way will be required for relocated Northern Avenue. Two 12-foot travel lanes and a 10-foot shoulder will be provided in each direction, separated by a 16-foot median with protected left-turn lanes. Ten-foot sidewalks will be provided on each side of the new roadway with a wider 20-foot promenade along the north side of the new bridge. Figure 3 depicts the typical roadway cross-section for relocated Northern Avenue. Typical cross-sections for Sleeper Street and a potential Seaport Access Road are presented in Figure 4. Figures 3 and 4 are at the back of the report.

The centerline of construction would be approximately 60 feet north of the existing New England Seafood Center and Pier Restaurant building at the eastern terminus. At the eastern edge of the Channel, the roadway centerline would be approximately 130 feet north of the existing Victoria Station Restaurant located on Sleeper Street. On the western side of the Channel, the roadway centerline would be approximately centered (60 feet) between the Sheraton Building and Hook Lobster Company.

The proposed relocated Northern Avenue roadway layout provides for at-grade intersections/connections at Atlantic Avenue, Sleeper Street, existing Northern

Avenue and at a potential Seaport Access Roadway. To properly interface the new facility with existing Atlantic Avenue, minor alignment changes will be required to the Central Artery off-ramp in front of the Sheraton Building. In order to accommodate the right turn from the Central Artery northbound off-ramp across Atlantic Avenue, modification of the existing ramp profile, the adjacent easterly retaining wall, and the location of the ramp terminus, would be required.

The northerly terminus of existing Sleeper Street would be relocated 140 feet east of its present location to provide for at-grade intersections with both relocated Northern Avenue and existing Northern Avenue (refer to Figure 1).

The proposed roadway layout also provides for an at-grade intersection at its eastern terminus with existing Northern Avenue and a potential Seaport Access Roadway. The layout of this intersection can be modified as adjacent land use plans are formalized. Furthermore, the proposed relocated Northern Avenue layout does offer some minor flexibility with regard to alignment. Modifications may be made to the alignment in the design phase of the project in response to specific development access and parcelization plans.

The segment of existing Northern Avenue between the old bridge and the intersection of the new roadway may be reduced in width, as it will no longer serve as a major arterial. The characteristics of this roadway will evolve as the plans for adjacent land uses become more definitive. It will serve as the access roadway to the adjacent development. A 44-foot roadway has been shown for this report along existing Northern Avenue.

Utility relocations in conjunction with construction of the new roadway would be the same as detailed in the 1974 report and would include relocation of Boston Edison Company's two 8-inch 115 kw lines that cross the Channel and construction of new water mains in the relocated segment of Northern Avenue. A new peripheral fire hydrant system along the edges of the Channel will also be constructed.

Geometric Design

The geometric criteria used to develop the proposed relocated Northern Avenue design are consistent with standards and procedures of the American Association of State Highway and Transportation Officials (AASHTO), the Massachusetts Department of Public Works (MDPW), and the City of Boston, and are summarized in Table 1. The proposed design calls for a maximum slope of 5.5 percent on the new Northern Avenue Bridge, providing a minimum vertical clearance of 16 feet at Mean High Water (MHW) over the Fort Point Channel, and 25.5 feet at Mean Low Water (MLW).

TABLE 1

GEOMETRIC DESIGN CHARACTERISTICS

RELOCATED NORTHERN AVENUE BRIDGE

DESIGN SPEED (MPH)	MAXIMUM SLOPE (%)		K-FACTOR*				MAX. STRUCT. DEPTH (FT.)	MINIMUM VERTICAL CLEARANCE OVER CHANNEL**	HEIGHT ABOVE EXIST. ℄ AT GLEN PLE STREET
			CREST		SAG				
	UP	DOWN	DES.	MIN.	DES.	MIN.			
40	5.5	5.5	64	55	55	55	5'-6"	16'-0"	4'-0"

*K = L/A where: A = Algebraic difference in grades (%)
L = Length of Vertical Curve (ft.)

** Above Mean High Water (MHW) level

Figures 5 and 6 at the back of the report illustrate profile elevations for relocated Northern Avenue and Sleeper Street, respectively.

The maximum height of the retaining wall required for the eastern abutment of the new bridge, north of the existing Victoria Station Restaurant, is approximately 12.5 feet. Relocated Northern Avenue as proposed will cross existing Sleeper Street approximately 4 feet above the existing grade and will require regrading of a portion of Sleeper Street, as shown in Figure 6, to properly interface the two roadways.

Bridge Design - Superstructure

The superstructure for the proposed Northern Avenue Bridge would consist of a reinforced concrete deck supported by continuous structural steel deck girders, fabricated of ASTM A-588 steel. In order to keep the piers clear of the navigable channel, as well as to minimize their number, a four-span layout has been proposed. The layout results in two center spans of 170 feet in length. An economical superstructure of minimum depth for these spans will require either structural steel or butted prestressed concrete box beams. The relative superstructure costs for either option are nearly the same. However, the substructure required for the heavier prestressed box beams would be more costly. On this basis, structural steel beams of corrosion resistant A-588 steel, rather than prestressed box beams, were selected and are recommended for the superstructure.

The bridge will be designed to accommodate maximum bridge loadings as specified by AASHTO and the Massachusetts Department of Public Works.

Pier Supports and Bridge Substructure

The piers for the support of the proposed bridge, depicted in Figure 7 at the back of the report, would be hammerhead reinforced concrete with pile-supported footings. The soil conditions at the site and the loads to be supported indicate that end-bearing piles to bedrock will be required.

Pier construction would be in the dry in cofferdams sealed at the bottom by tremie concrete. The piles would be driven prior to placement of the tremie seal and cut off above the seal after dewatering of the cofferdam. Granite facing will be placed over the sections of the concrete piers in the water or tidal range.

Hydraulic Considerations

As described in the 1974 report, Fort Point Channel functions as a tidal drainage system for stormwater and sewage overflow from a tributary area of over 2700 acres.

Since the proposed design for the new Northern Avenue Bridge will not require an embankment in the Channel and will require only three pier supports for the four spans, tidal drainage should not be significantly different than existing conditions. Additionally, the tidal flushing action and peak storm water flows should not be significantly impaired during the construction of the proposed bridge crossing.

Construction Methods

The construction process for the new Northern Avenue Bridge would be as follows. The bridge's pier supports would be constructed in the dry through the use of cofferdams sealed with tremie concrete. Piles would be driven prior to the pouring of the tremie concrete seal. Following construction of the piers, the superstructure would be erected utilizing barge-mounted cranes. The girders for the end spans could be erected as a single length from abutment to the splice in the center spans. As an alternative, depending on the availability of equipment, the section of girders over the piers could be erected and temporarily held in position by falsework. The center section of each girder could then be spliced to these sections and the falsework removed. These same options would also be available for the construction of the center spans.

The construction of the roadway approaches on either side of the Channel should cause no major disruptions to traffic, since the majority of construction is on vacant land. Traffic flow will be maintained over Fort Point Channel via the existing Northern Avenue Bridge. During the construction of intersections at Atlantic Avenue, Sleeper Street and connections to existing Northern Avenue, the flow of traffic along existing streets will be maintained. Access to adjacent land will be

maintained throughout the construction cycle. In general, all construction methods and procedures will conform to MDPW "Standard Specifications for Highways and Bridges" (1973, as amended) and appropriate City of Boston standards and specifications.

Construction Costs

The estimated construction cost of the proposed Northern Avenue relocation, including roadway and bridge elements, is presented in Table 2 on the next page. The estimated construction cost of the proposed facility is $9.8 million, not including engineering design, land acquisition and relocation costs. The estimate, itemized by major construction categories in Table 2, is based upon 1979 prevailing bid prices for material and labor costs.

For budget purposes, engineering design costs were estimated at $700,000 and land acquisition and relocation costs were estimated at $1,070,000. Thus, the total project cost is estimated to be approximately $11,570,000 in 1979 dollars.

Land Acquisition/ Relocation Requirements

Figure 8 at the back of the report shows the existing approximate boundaries and ownership of land parcels which will be affected by the proposed design for relocated Northern Avenue. Although right-of-way details are preliminary and would not be finalized until the later final design stage, it appears that the only commercial establishment presently in operation which must be acquired and relocated is the McKie Lighter Company operation, located along the eastern side of Fort Point Channel. The property's listed owner is Farrell's Dock and Terminal Company. The relocation requirements of the company were documented in the MDPW Relocation Report, prepared in conjunction with the 1974 feasibility study. All other right-of-way requirements for the project are in the form of partial land acquisitions. The nature and size of these acquisitions for the roadway right-of-way will be finalized in the later design stage of the project. The properties affected by partial land acquisition are depicted in Figure 8.

All right-of-way acquisition, property takings and relocation procedures will be conducted in accordance with standard State and Federal policies and procedures. The MDPW would be responsible for all land acquisition and relocation costs.

Traffic and Pedestrian Circulation

Existing (1979) daily traffic volumes crossing Northern Avenue total approximately 17,000 vehicles (both directions). Based upon local and regional traffic growth and proposed land development within the study area, it appears that vehicular crossings over a relocated Northern Avenue may increase by approximately 40 percent to 24,000 vehicles daily by 1995.

TABLE 2

1979 ESTIMATED CONSTRUCTION COST [1,2]

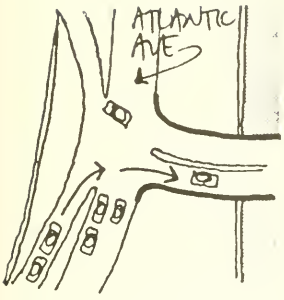
ITEM	ESTIMATED COST (1979 DOLLARS)
Earthworks	$ 390,000
Excavation and Disposal (polluted materials)	100,000
Roadways	800,000
Drainage	435,000
Water Mains	490,000
Lighting, Signing and Signalization	675,000
Temporary Traffic Control	155,000
Bridge Structure	3,800,000
Bulkheads	480,000
Retaining Walls	125,000
Landscaping and Walkways	400,000
Miscellaneous Construction	565,000
Peripheral Fire Hydrant System	60,000
Sub-Total	8,475,000
+ 15% Contingency	1,272,000
TOTAL	$9,747,000
say	$9,800,000

(1) Does not include engineering design costs. A budget amount of $700,000 is suggested for estimating purposes.

(2) Does not include land acquisition or relocation costs. A real estate market survey will be required to accurately reflect right-of-way and relocation costs. In the absence of such a real estate market survey, right-of-way and relocation costs were estimated to be approximately $1,070,000. The actual fair market value of individual parcels may vary greatly.

As discussed in Section IV, ENVIRONMENTAL IMPACTS UPDATE, forecasts of year 1995 trips generated by the Northern Avenue industrial/commercial area were contained in the 1974 report. These forecasts were based on anticipated land uses as they were known at that time. Based on the current land use and development plans, the total trips originating or destined for the Northern Avenue area are projected to be approximately 20 percent lower than originally forecast in the 1974 report. However, this still translates into a 40 percent increase over the level of traffic currently using the Northern Avenue Bridge.

The revised and updated future land uses are expected to exhibit traffic peaking characteristics similar to those associated with the land use assumptions presented in the 1974 report. Therefore, new estimates of peak and off-peak traffic volumes are expected to be somewhat less than originally shown in the 1974 report, but still significantly higher than existing levels.



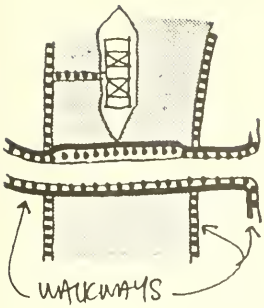
Atlantic Avenue at new Northern Avenue

Traffic signalization control will be required at the intersection of relocated Northern Avenue and Atlantic Avenue. The critical traffic movement at this location is the right turn from the Central Artery northbound off-ramp, across Atlantic Avenue to the new Northern Avenue Bridge. A demand responsive signal system with possible over-riding capabilities will be required at this location. The signal system will give preferential treatment to the traffic on the Central Artery off-ramp to avoid backups extending to the Artery itself. Sensors in the roadway will be able to monitor the length of the traffic queue on the ramp and adjust the signal phasing accordingly.

Signalization may be required at the intersections of relocated Northern Avenue/Sleeper Street and relocated Northern Avenue/existing Northern Avenue/Seaport Access Road and must be the subject of further design development. Future adjacent land uses and access requirements will be important in determining the signalization needs at these two locations.

In a general sense, future traffic operations within and external to the Northern Avenue area are not expected to be significantly different than previously identified in the 1974 study. However, traffic operations at isolated locations must be related to specific land use development, parcelization and associated access locations, and entering/exiting operations. The development details required for such an analysis are not available at this time, but flexibility does exist to accommodate development access. It is assumed that this access refinement process would occur during the final design phase of the project.

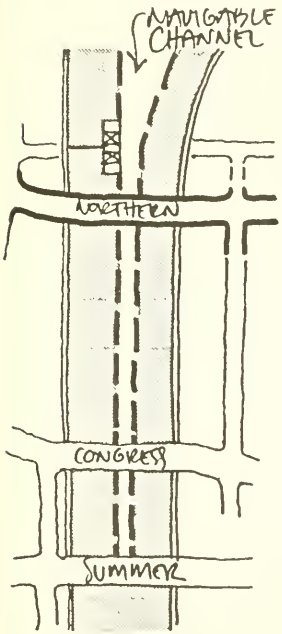
During construction of relocated Northern Avenue, the existing Northern Avenue Bridge and roadway would remain open. Some minor traffic disruptions during construction would occur along existing Northern Avenue in the area of B Street, Sleeper Street, and at the Atlantic Avenue intersection.



Walkways at new bridge

In addition to improved vehicular circulation, improvement to pedestrian amenities and pedestrian circulation is an important component of the proposed relocated Northern Avenue design. Pedestrian routes will be established that pass over the Channel on the bridge, and the opportunity also exists for pedestrian paths under the proposed new bridge adjacent to the abutments on both sides of Fort Point Channel. The renderings on the following page illustrate potential pedestrian walkways that could be established beneath the new bridge at both ends of the Channel. The pedestrian circulation system, established in conjunction with the construction of the new bridge, will be compatible with the goals, objectives and policies of the City's recently completed "Boston Harbor - Challenges and Opportunities for the 1980's" study.

Channel Navigation

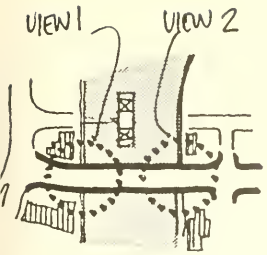


Location of navigable channel

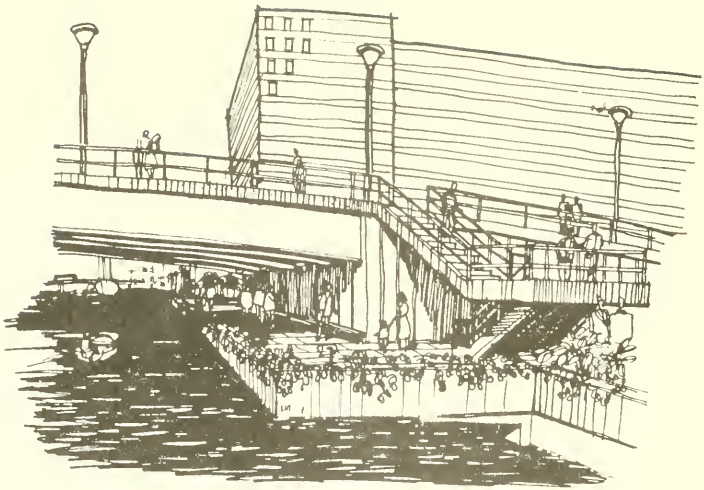
The existing navigable channel along the Fort Point Channel will not be altered by the proposed bridge construction. As indicated in the 1974 MDPW Report, the existing navigable channel varies between 175 feet in width at the mouth of Fort Point Channel to widths of 75 feet at the Northern Avenue Bridge, 75 feet at the Congress Street Bridge, and 70 feet at the Summer Street Bridge. (Navigation beyond Congress Street and Summer Street is constrained by the vertical clearances at these points, 6 and 4 feet above MHW, respectively. The Congress Street Bridge may be open by special arrangement. The Summer Street Bridge is fixed closed.) The navigable channel passes to the east of the center foundation of the existing Northern Avenue Bridge. The proposed bridge pier and substructure locations will not encroach upon the navigable channel. Figure 2 at the back of the report shows the relationship between the proposed bridge piers and the defined navigable channel.

The proposed fixed-span Northern Avenue Bridge, however, will restrict navigation south of the bridge to vessels with vertical clearance requirements less than 16 feet above MHW. It is worth noting that the tidal range in the Channel area is approximately 9.5 feet, such that at low tide, 25.5 feet of vertical clearance would be available under the proposed new bridge.

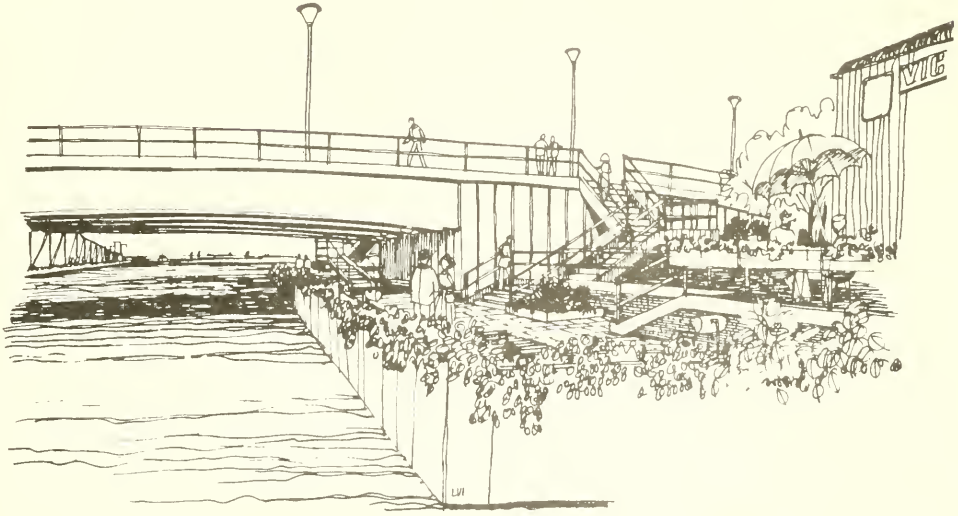
The impact of the proposed bridge on both vertical and horizontal clearance in Fort Point Channel is discussed in detail in Section III of this report, under the



Location map



View 1: Rendering of walkway at west bridge abutment



View 2: Rendering of walkway at east bridge abutment

headings Channel Navigation - Vertical Clearance, and Channel Navigation - Horizontal Clearance.

Existing Northern Avenue Bridge

During construction of the proposed bridge, the existing Northern Avenue Bridge will remain open and in operation. However, upon completion of the new bridge, the existing bridge will be fixed open and closed to vehicular traffic.

Several proposals are presently being considered for re-use and rehabilitation of the existing bridge as an historic/recreation and/or marine facility. As discussed in the "Boston Harbor - Challenges and Opportunities for the 1980's" study, marina and pedestrian uses are presently being considered for the Fort Point Channel area. The existing Northern Avenue Bridge will be an integral part of a waterfront recreation plan. The re-use of the existing bridge will be the subject of a separate study by others.

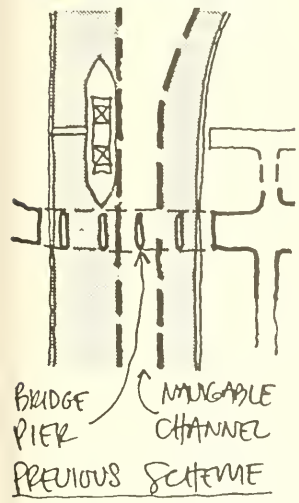
III. RESOLUTION OF DESIGN ISSUES

This section of the report responds to the specific issues raised with regard to a new bridge. Analyses of the various options available are included where appropriate.

Channel Navigation - Horizontal Clearance

The issue of horizontal clearance in the Channel became a critical design consideration for any Northern Avenue Bridge replacement proposal with the City's recent decision that the existing bridge will remain. Previous studies had assumed that the existing bridge would be removed once a new bridge was constructed.

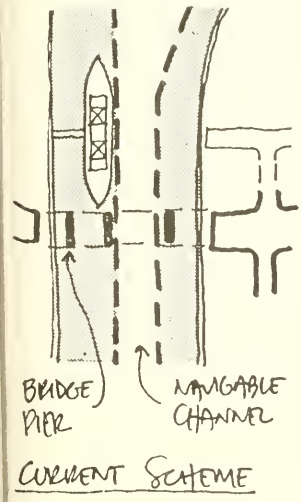
With the existing bridge retained, the location of the replacement bridge support piers becomes important. The navigation channel as defined by the existing Northern Avenue Bridge is 75 feet wide and located just east of the center foundation of the bridge. The plan entitled "Fort Point Channel, Boston Harbor, Condition Survey, U.S. Army Corps of Engineers, April, 1978" confirms this location of the navigation channel.



Bridge Pier Locations- Previous Bridge Scheme

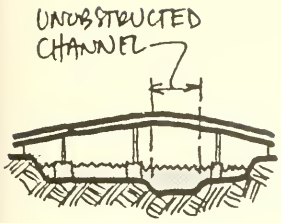
The previous bridge replacement scheme (Scheme C-3 Modified) as contained in the 1977 supplementary report proposed a five-span bridge, with four pier supports and foundations located in Fort Point Channel. One of the pier supports fell within the navigation channel defined by the existing bridge. Under this scheme it was assumed that a vessel could still maneuver around the pier abutment since it would have been located approximately 150 feet downstream from the existing bridge. However, the vessel operator would be required to navigate to either the port or starboard to avoid the new pier. It is this infringement upon horizontal clearance that was cited by the Corps of Engineers in contesting the permit application for the previous design proposals.

As part of the current study, different pier support arrangements were examined for 4-span, 5-span and 6-span bridge designs. These designs would require 3, 4 and 5 piers, respectively, for support of the bridge. The 5-pier design would result in the shortest bridge-span lengths with the longest span 120 feet. Conversely, the 3 pier design would result in the longest span lengths, with the longest span approximately 170 feet. An advantage of the shorter span lengths is that smaller beams can be used for the spans, allowing for greater vertical clearance (beams are up to 1-foot shallower in depth). However, the 3-pier scheme provides the best alignment with the navigable channel. Cost savings can also be realized by having to construct only 3 piers in



ridge Pier Locations- urrent Bridge Scheme

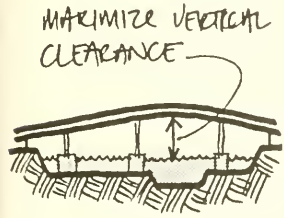
the Channel as opposed to 4 or 5 under the other design schemes.



Location of piers with regard to navigable channel

The 3-pier scheme allows the center pier of the new bridge to be located approximately in line with the center of the existing Northern Avenue Bridge. This allows an unobstructed alignment of the new bridge's 170-foot span across the 75-foot navigation channel. The approximate high point of the new bridge will be centered over the navigation channel. The 3-pier bridge structure will place the fewest obstacles in the existing Channel and will result in a symmetrical structure across the Channel with the center pier centered in the Channel and the other two piers equidistant on either side. For these reasons, the 3-pier (4 span) configuration is recommended as the preferred proposal for a Northern Avenue Bridge replacement. Figure 2 at the back of the report depicts an elevation view of the bridge structure.

Channel Navigation - Vertical Clearance



Vertical clearance under bridge was investigated

Vertical clearance under a Northern Avenue Bridge replacement at MHW in Fort Point Channel has been a prime consideration in the design of a new bridge. A fixed-span bridge would pose limits on some forms of navigation in the Channel. The existing Channel is navigable to the Summer Street bridge which is fixed closed. However, from a practical point of view, the Channel is only navigable to the Congress Street Bridge since that bridge is opened only in response to special requests. Therefore, the issue of limits to navigation due to vertical clearance restrictions deserves closer scrutiny.

The proposed schemes for a Northern Avenue Bridge replacement, as contained in the original 1974 MDPW report, and the later Scheme C-3 Modified proposal, as contained in the 1977 supplemental report, would have provided 15 feet of vertical clearance above MHW. This limited vertical clearance would restrict the passage of the McKie Lighter Co. B-95 Barge and Crane combination, the ocean-going tugs operated by McKie Lighter Co., large tugboats operated by others for use in dredging the Channel, the City of Boston and Massport fireboats, and most sailboats. Most motor-powered pleasure craft and lobster boats less than 40 feet (typically with a lesser than 15 foot height) would be able to navigate under the bridge. Table 3 on the next page lists various types of watercraft that might use the Channel and their vertical clearance requirements.

As part of this study, a re-examination of the vertical clearances achievable for a new Northern Avenue Bridge was performed. Suggestions have been made that clearances in the range of 20 to 25 feet above MHW in the Channel should be provided. A new profile was developed for schemes aimed at providing 20 feet of

TABLE 3

VESSEL VERTICAL CLEARANCE REQUIREMENTS

TYPE OR CLASSIFICATION	LENGTH	VERTICAL CLEARANCE REQUIRED
• Ocean Tugboat	100'-125'	Greater than 16', typically 30' to 40'
• Small Tugboat* (Perini Corp.)	40'-45'	10'-12' with mast down
• Motor-Powered Boats (Pleasure Boats)	less than 40'	Generally less than 15' (without flying bridge)
• City of Boston Fireboat		27'
• McKie Lighter		Greater than 60'
• Lobster Boats	varies (15' - 40')	Generally less than 15' (without flying bridge)
• Sailboats		
- Cape Dory 10	10'-6"	15'-9"
- Sunfish	13'-10"	15'-1"
- O'Day 15	14'-11"	23'-4"
- Challenger	15'-0"	24'-4"
- Day Sailor	16'-9"	25'-1"
- Cape 25	24'-10"	31'-0"
- Soling	26'-9"	31'-3"
- Challenger 35	34'-8"	40'-0"
• Commuter Boats	varies	Greater than 25'
• Hovercraft (as used in Boston)		13'-4"

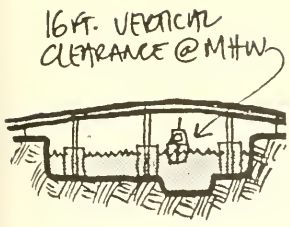
*This smaller version tugboat can be used for dredging operations where vessel vertical clearance is a factor.

vertical clearance above MHW with a maximum road gradient of 5.5 percent. The resultant profile would be generally similar to the previous proposals on the western side of the Channel where the new bridge connects to Atlantic Avenue. At the center of the channel over the navigable channel segment, 20 feet minimum vertical clearance could be provided. However, from this point eastward, the roadway profile would be significantly different from previous proposals. At the abutment on the east edge of Fort Point Channel, the roadway would be 22.5 feet above existing ground versus the 12.5 feet for previous proposals. At Sleeper Street, the roadway would be 16 feet above existing ground versus the 4- to 5-foot difference under previous proposals. These heights would prevent any connection of Northern Avenue to Sleeper Street, and would have serious visual and access impacts on the Victoria Station Restaurant and serious access impacts on the Neptune Lobster Company, both on the east side of the Channel. Sleeper Street would most likely have to be dead-ended or the new roadway raised even higher to allow Sleeper Street to pass under. Direct access from Northern Avenue to Victoria Station, the Wolfer Building and Neptune Lobster Company would not be possible. The feasibility of developing adjacent vacant land would also be negatively affected.

A roadway profile which provides 25 feet of vertical clearance above MHW would have even more serious implications on the height of the east side roadway approach, with the roadway over 27 feet above existing ground at the east edge of the Channel and over 20 feet above the existing ground at Sleeper Street.

Another factor considered in the analysis of the advantages and disadvantages of increased vertical clearance was the additional marine traffic that might be served by an increased vertical clearance. As Table 3 shows, most sailboats could still not make it under a 20-foot clearance, and a 25-foot clearance will only provide sufficient clearance for small Day Sailors. The McKie Lighter Co. crane and tugboats, the City of Boston fireboat, ocean tugboats, and ferry service boats now servicing Boston Harbor could still not be accommodated even with a 25-foot clearance.

This analysis indicates that were a vertical clearance of 20 or 25 feet provided, the resulting bridge and roadways would visually affect properties east of the Channel, would prevent access connections to Sleeper Street or adjacent development, and would enable only a few additional types of marine traffic to clear the bridge that could not clear a bridge providing 16 feet of vertical clearance at MHW.



Proposed scheme provides 16 feet clearance at MHW

Revaluations of the previous roadway profiles developed in the 1974 and 1977 reports were performed to examine if any small gains in vertical clearance could be made without violating safety criteria or other physical parameters. A new profile was developed with a 5.5 percent maximum roadway grade (versus the previous 5 percent grade), which resulted in a 16-foot vertical clearance above MHW in the Channel. This new profile would still allow safe sight distances for vehicular traffic on the bridge and allow for an at-grade connection at Sleeper Street, with only minor regrading of the adjacent areas. The new profile would also allow pedestrians to pass under the bridge structure along the eastern shoreline of the Fort Point Channel, consistent with the City's plans for future waterfront development. This new profile is recommended and depicted on Figure 5 at the back of the report.

The 16-foot vertical clearance provided by the recommended profile will affect navigation in the Channel in the following ways:

1. Ocean-going tugboats, used in dredging the Channel, will not clear the new bridge. However, the Channel can be dredged by a barge and crane combination moved into the Channel at low tide, when approximately 25 feet of clearance under the new bridge would exist. The barge could be towed to and from the harbor side of the existing Northern Avenue Bridge by a smaller tugboat requiring less than 25 feet of vertical clearance. From there, an ocean going tugboat could tow the barge with the dredged materials out to sea. This type of procedure was recently used for the construction of the Charles River Dam. It is anticipated that dredging would not occur more than once every ten years, and possibly even less frequently.

2. Fireboats will no longer be required to pass under the new bridge since a new waterfront hydrant system will be installed along both sides of the Channel as part of the project. Thus, vertical clearance for fireboats need not be considered.

3. Most sailboats will not be able to clear the new bridge, other than small Day Sailors less than 13 feet long which generally have mast heights less than 16 feet. Marinas for sailboats will most likely be developed north of the existing Northern Avenue Bridge as part of Boston's waterfront development plan. A marina for motor-powered boats could be located in the Channel, south of the proposed bridge.

4. Most motor-powered pleasure boats less than 40 feet in length should be able to clear the new bridge. This also includes most lobster boats except those with a flying bridge. Both Neptune Lobster Company and Hook Lobster Company will be located north of the proposed new bridge, so presumably there is no need for their boats to pass under the new bridge, although they could.

5. The Boston Tea Party Ship could clear the proposed new bridge if the masts of the vessel were taken down. It has been previously agreed that this procedure would be followed if the vessel is to be relocated to another permanent location.

6. The Hovercraft currently operating in Boston Harbor requires 13.5 feet clearance and could clear the proposed new bridge if service were to be provided upstream of the new bridge. If it were desired that other commuter boats operate out of the Channel, they would have to be specially designed to clear the proposed new bridge. The Executive Office of Transportation and Construction (EOTC) has specifically stated, in response to an inquiry for this report, that there are no current or future plans to provide commuter boat service south of the Northern Avenue Bridge in the Channel.

7. The McKie Lighter Company's B-95 barge/crane rig and its ocean tugboats will not fit under the new bridge. The acquisition of the company's docking space along the Channel is also required as part of the right-of-way for the new roadway. Relocation of the company's facilities to another location under the MDPW's Relocation Program appears mandated by any Northern Avenue Replacement scheme. Relocation to another location, in South Boston if possible, should be considered.

8. The Fort Point Channel area has a tidal range of 9.5 feet, such that all other boats, vessels and barges up to 25 feet vertical height could be brought into the Channel, as special occasions might dictate, at low tide. Additionally, at mid-tide there would be a vertical clearance in excess of 20 feet. This vertical clearance would be available approximately 12 hours per day.

lternative Alignments

Throughout the previous Northern Avenue Bridge studies, the issue of alternative alignments has often been raised. In the 1974 report, alternative alignments for a new bridge were studied extensively (Pg. 40 of the report). Seven sets of alignments with the western termini of the bridge ranging from a location near Harbor Towers to a location south of the Sheraton

Building were studied. These alignments were examined for their design implications and five of the seven sets were eliminated due to serious route deficiencies. Only two groups were advanced for further detailed study.

The groups of alignments selected for further study in 1974 included those connecting to Atlantic Avenue in the vicinity of Hook Lobster Company and those that connected to a new Atlantic Avenue, north of the U.S. Appraiser's Stores. The latter group of alignments was later dropped because "The proposal also represents the most complex and costly scheme, requires the most construction time, imposes the greatest aesthetic and environmentally adverse impact, requires the most property taking, and would require the most reconstruction if a depressed Central Artery is built." Thus the general area for the most favorable alignment was narrowed down to a location south of the existing bridge, connecting to Atlantic Avenue in the vicinity of the northbound off-ramp from the Central Artery, proceeding across Fort Point Channel, and connecting to existing Northern Avenue at B Street.

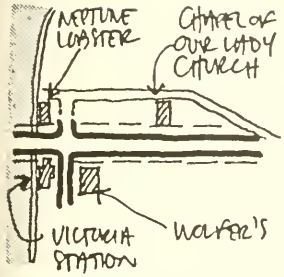
Within this preferred corridor, south of the existing bridge, two alternative alignments (C-2 and C-3 in the 1974 report) were studied. The difference between the two was that Scheme C-2 included provisions for potential direct ramp connections to the Central Artery in the future. Both schemes provided at-grade connections to Atlantic Avenue about 100 feet south of the existing Northern Avenue connection. Both alignments required the acquisition of the Hook Lobster Company building.

In 1977, Scheme C-3 was modified by shifting the roadway further southward to avoid the taking of the Hook Lobster Company building. The resulting alignment was thus located between the Hook Lobster Company building on the north side and the Sheraton building on the south side. This alignment avoided the taking of either building and fixed the location of the bridge approach on the west side of the Channel. There is little leeway to shift the alignment in either direction without requiring the taking of one of the buildings. The connection to Atlantic Avenue is retained in the current recommended design proposal. Some modifications to the Central Artery off-ramp including regrading of the off-ramp and relocation of the ramp nose will be required. Traffic signals will also be required for the Atlantic Avenue/Relocated Northern Avenue intersection.

From Atlantic Avenue, the Northern Avenue Bridge replacement would move through a 1000-foot radius curve to a straight line tangent section across the Channel to Sleeper Street. From Sleeper Street, another 4000-foot

radius curve and a tangent section would connect to existing Northern Avenue at B Street. This alignment is generally similar to previous proposals except that it is located about 30 feet further to the north.

The currently proposed alignment on the east side of the Channel will require the acquisition of a small dock office of McKie Lighter Company and some of the firm's docking space along the eastern edge of the Channel. However, relocation of the McKie firm will be required because of the vertical clearance requirements of the firm's tugboats and barge/crane combination discussed in the previous section.



Proposed Northern Avenue alignment

The relocated Northern Avenue alignment on the east side of the Channel will bisect the Penn Central property between existing Northern Avenue and Congress Street. Some flexibility exists in the final design to shift this segment of relocated Northern Avenue either slightly north or slightly south. Shifting the roadway to the north will bring it closer to the Chapel of Our Lady Church and Neptune Lobster Company. Shifting the roadway to the south will bring it closer to Victoria Station and the Wolfer Building and it will require a steeper grade for the Sleeper Street connection to the relocated roadway. The alignment that is shown in Figure 1 is preferred, although slight variations are possible, to accommodate future development. The determination of a fixed computed alignment will be the subject of the final design development phase which will follow upon acceptance of this study.

Land Acquisition/ Relocation

A major consideration in the development of a successful Northern Avenue bridge replacement scheme has been to minimize business relocations and property takings. As discussed in Section I, INTRODUCTION, the needs of property owners on both the east and west sides of the Fort Point Channel were taken into account during design development of alternative bridge alignments.

As previously indicated, it appears that the McKie Lighter operation is the only existing business which will have to be acquired and relocated as part of the Northern Avenue Bridge replacement project. All other property takings required will be in the form of partial property acquisitions with current commercial activities on the properties able to continue. Figure 10 at the back of the report depicts the properties affected by the roadway right-of-way.

Fireboat Access

A previous concern for a new bridge over Fort Point Channel involved the vertical clearance requirements of the City of Boston fireboats. At the present time, the Fire Department relies on fireboats for protection along Fort Point Channel, as far south as Summer Street. The 1974 report noted the possibility of providing

additional hydrants and water mains paralleling the Channel, to serve as an alternative means of fire protection in this area.

In June 1978, the Boston Fire Department obtained an agreement with the MDPW for the installation of a peripheral hydrant system along the Fort Point Channel in conjunction with the construction of a new bridge. The new system will be sufficient to provide the necessary fire protection from land and will eliminate the need for water based protection in the Channel. The new hydrant system would be constructed prior to the new bridge construction.

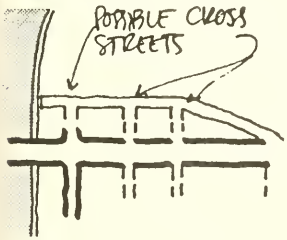
Existing Northern Avenue Bridge

In 1976, the existing Northern Avenue Bridge was identified as being eligible for listing on the National Register of Historic Places, as determined by the Office of Archeology and Historic Preservation of the Interior Department. Prior to that time it was assumed that, due to its poor structural condition, the bridge would be removed upon completion of the new bridge. Shortly thereafter, the City of Boston stated its intention to retain and preserve the existing bridge as an historic landmark.

Both the Federal Highway Administration and the Massachusetts Historical Commission later concurred that construction of the proposed Northern Avenue Bridge will have no direct effect upon the historic significance of the existing bridge, and that the new bridge can be treated as a separate project since the existing bridge will remain. Several proposals are presently being considered for re-use of the existing bridge as an historic/recreational facility. The recently completed "Boston Harbor-Challenges and Opportunities for the 1980's" study identifies the general goals, objectives and policies for the re-use of this facility.

Existing Northern Avenue, East of Fort Point Channel

Upon completion of the proposed relocated Northern Avenue, the existing Northern Avenue Bridge will be closed to vehicular traffic. However, existing Northern Avenue, east of Fort Point Channel, will remain open. One or more connections from existing Northern Avenue to relocated Northern Avenue will be provided as part of the proposed project. The location of future connections between the two roadways will be integrated with the development plans for adjacent parcels.



Possible cross-street connections

With the existing bridge closed, the Northern Avenue segment between B Street and Fort Point Channel will be utilized primarily as an access roadway servicing adjacent existing and future development, and will be modified in keeping with the adjacent land use plans as they are defined.

Third Harbor Tunnel/ Depressed Central Artery

Two major trarsportation improvement projects, both of which would have secondary impacts upon the proposed Northern Avenue Bridge relocation, have been proposed by others to relieve congestion and improve operations along the Central Artery. These major projects are:

- The Third Harbor Tunnel, and
- The Depression of the Central Artery.

The Third Harbor Tunnel project is currently under study by the MDPW. Preliminary studies are being performed by the MDPW with a report due to the State Legislature in early 1980.

The Depressed Central Artery project, which has been proposed in the past, would involve major reconstruction of the Central Artery. This future project is not considered a high priority by the current State Administration.

As currently proposed, the Third Harbor Tunnel project would provide a tunneled roadway across Boston Harbor, originating along the west side of Fort Point Channel just north of the existing Northern Avenue Bridge and progressing across the Harbor to East Boston. The connections to the Tunnel in the Northern Avenue area would include ramp connections directly to Northern Avenue and tunneled roadways connecting the Tunnel to the Central Artery.

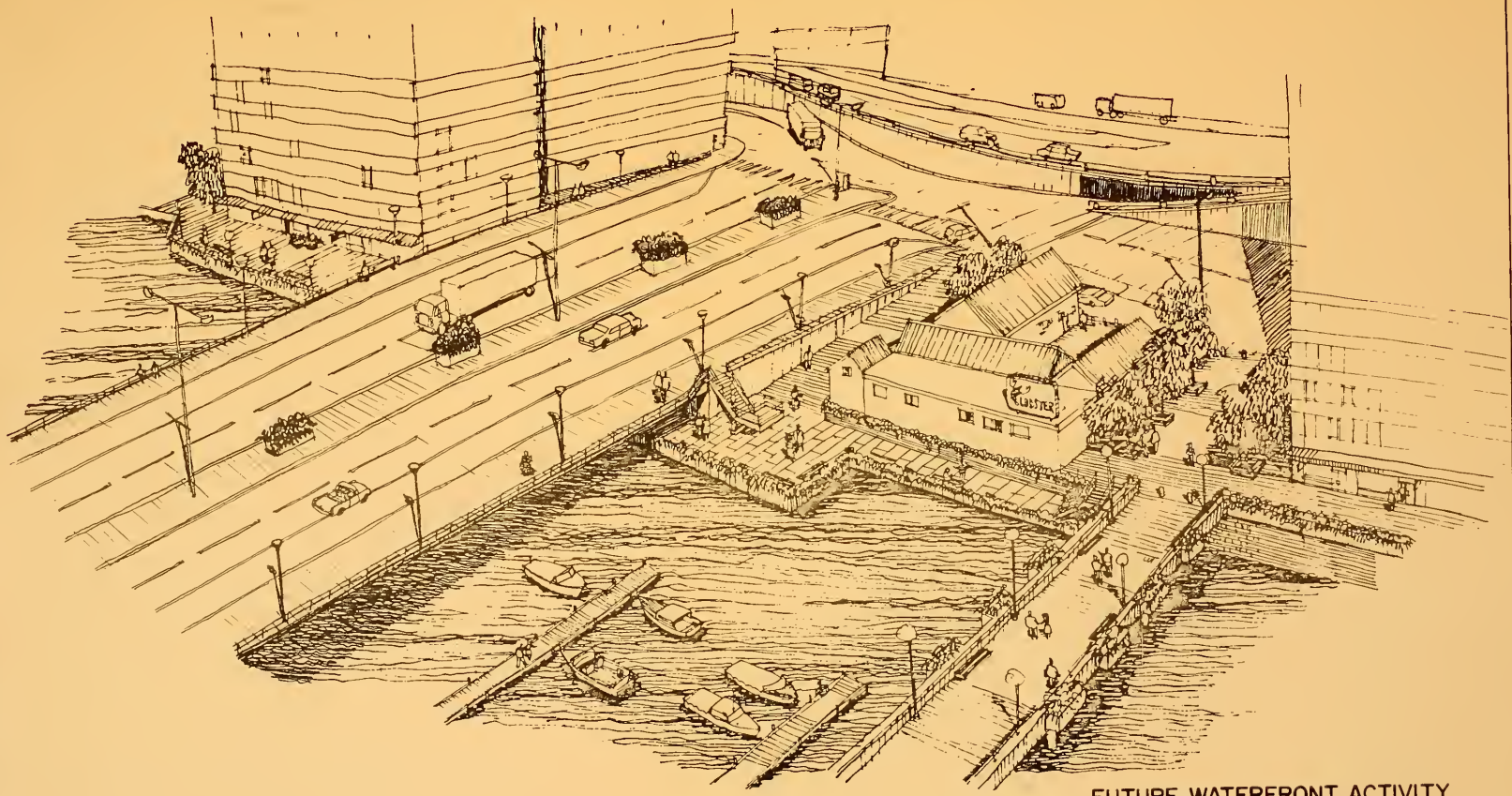
The Depressed Central Artery project would locate the northbound barrel of the Artery in a tunnel along the west side of Fort Point Channel. Ramp connections up to Northern Avenue from the tunnel would be provided.

For both projects, the tunneled roadway segments in the Channel would pass under the new bridge. Both projects would be compatible with the proposed bridge design at Northern Avenue.

Future Waterfront Activity

Recent revitalization programs carried out in the downtown waterfront and Faneuil Market area have drawn attention to the development potential of waterfront land and underutilized buildings throughout the Harbor. Fort Point Channel is one of several areas in the Inner Harbor slated for substantial public and private investment over the next ten years.

Proposals call for development of a system of public waterfront walkways from the downtown Waterfront Park to Northern Avenue and along both sides of the Fort Point Channel. Public open spaces are proposed along the walkways, including small waterfront park areas on Rowes Wharf, Russia Wharf, Pier 1 and various locations along the Channel. Figure 9 on the following page is a



FUTURE WATERFRONT ACTIVITY
AT
FORT POINT CHANNEL

NORTHERN AVENUE BRIDGE REPLACEMENT STUDY
FST/WFEM FIGURE 9

rendering of future waterfront activity at Fort Point Channel.

Public landings for small craft are proposed at Northern Avenue and along the Channel, and new boat basins are suggested at the existing Northern Avenue Bridge area and in Fort Point Channel.

Extensive rehabilitation and new residential, commercial, office and warehousing development is also proposed for sites along the waterfront and Fort Point Channel. The following list outlines the extent of current development proposals by various developers for major land parcels in the area.

- South Station
  MBTA, owner

A transportation center for intercity and commuter trains is proposed, with a new facility to handle intercity and regional bus lines, a 2000 car parking garage, and a hotel/office complex to be built by the BRA at a later date.

- Russia Wharf
  Russia Wharf Company, owner

The existing buildings are in the process of being rehabilitated for office and commercial uses.

- Wilcox Warehouse and Appraiser's Building
  General Services Administration, owner

These buildings are to be renovated for the use of the Coast Guard and other federal agencies.

- Rowes Wharf and Fosters Wharf
  Boston Redevelopment Authority, owner

The City is interested in selling these properties to a developer and having commercial and residential buildings constructed along with terminal facilities for commuter and other boat service.

- Piers 1 through 4
  Anthony Athanas, owner

A new development including 1000 units of new market rate housing, a 400 room hotel, a parking garage and a marina has been proposed for this property.

- Penn Central Rail Yards
  Penn Central Corporation, owner

The yards are under option to Broderick Properties who propose development of offices and a trade center.

- Sites on Farnsworth, Pittsburgh and Stillings Streets
  Town and City Properties, owner

Renovations to existing warehouse buildings are proposed. Conversion to residential use with some office and commercial uses is envisioned.

- Necco and Midway Streets
  Town and City Properties, owners

The existing warehouses are to be renovated and new buildings constructed for office, commercial and residential uses.

- Commonwealth Pier, Fish Pier, and Commonwealth Flats
  Massachusetts Port Authority, owner

Commonwealth Pier is to be rehabilitated and a trade mart, exhibition space, and a foreign trade zone established. The Pier will retain facilities to handle cruise ships.

The Fish Pier is being renovated so that fish handling capacity can be increased by 50% from 27 to 40 million pounds a year.

Commonwealth Flats will be used for new car storage and eventually for warehousing and manufacturing facilties.

IV. ENVIRONMENTAL IMPACTS UPDATE

General

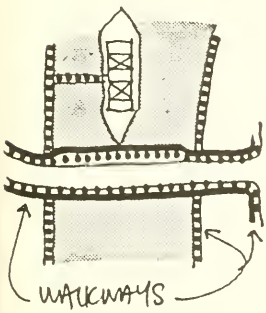
The initial 1974 report, "Replacement of Northern Avenue Bridge and its Approaches over Fort Point Channel, Feasibility Study, Environmental Assessments and Basic Design" contained an environmental assessment of the potential impacts of a proposed Northern Avenue Bridge replacement. A Negative Declaration, dated September 20, 1974, for the project was approved by the Massachusetts Department of Public Works (MDPW) and Federal Highway Administration (FHWA) in January of 1975. The "Supplementary Report, Scheme C-3 Modified," dated August, 1977, updated the potential environmental impacts of the project as identified in the initial 1974 report and the Negative Declaration. The purpose of this section is to update the potential impacts of the project. Specifically this section indicates whether any change in potential impacts will result from the revised alignment recommended in this report beyond those described in the original 1974 environmental assessment. In many cases, the impacts of the current proposal are similar to those previously identified. Reference is made to Section 5.9 and 5.10 of the 1974 report and to pages 4, 5 and 6 of the 1977 supplementary report.

Short-Term Impacts

The following is an assessment of short-term impacts of the proposed Northern Avenue Bridge replacement.

Public Transportation

No change.



Pedestrian walkways at new bridge

Pedestrian Activity

The proposed alternative scheme will not affect pedestrian access in South Boston or in the area of the Atlantic Avenue/Northern Avenue intersection. Positive provisions will be made in the design of the bridge for pedestrian walkways under the bridge on both sides of the Fort Point Channel. The walkways will be consistent with plans by the City of Boston to develop waterfront pedestrian walkways along the harbor's edge, and will provide an additional crossing of Northern Avenue other than at-grade.

Other Municipal Services

No change.

Water Quality

The potential short term water quality impact from dismantling the existing Northern Avenue Bridge will no longer be applicable, since a decision to retain that bridge has been made. The potential short term turbidity to be caused in the Channel from the dredging and new construction in the Channel will be similar to that described in the 1974 report.

Waste Disposal

It is estimated that the dredging of silt and clay from the Channel bottom will amount to approximately 37,000 cubic yards, of which 10,000 cubic yards will be of highly polluted material. The offshore disposal site designated by the U.S. Army Corps of Engineers can be used for the highly polluted excavated material. This site is located 9.3 nautical miles from Boston Light at 56 degrees true and 12.0 nautical miles from Marblehead at 112 degrees true. Onshore sites, if available, must be designated by the City of Boston.

Air Quality

No change.

Noise

No change.

Tax Base

No change.

Employment

Under the proposed alternative scheme, the McKie Lighter Company will be displaced. It is anticipated that a suitable relocation site can be found and that there will be no loss of employment. A warehouse at the corner of Sleeper Street and Northern Avenue, which previously would have been displaced under this scheme and each of the previous schemes, was recently destroyed by fire. Since there are no plans to rebuild the warehouse, the taking of this property will not result in the loss of any jobs.

Summary of Short-Term Impacts

No significant change.

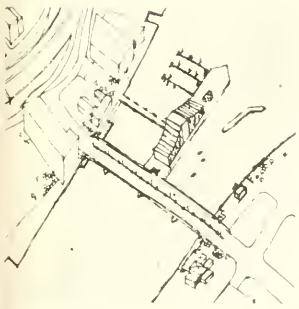
Long-Term Impacts

The following is an assessment of the long-term impacts of the proposed Northern Avenue Bridge replacement scheme.

General Channel Usage

A new bridge will provide a stimulus for increased active and passive use of the Fort Point Channel area. New developments which will increase the potential usage of the Channel area and Inner Harbor water's edge include:

- The Town and City Properties housing and office proposal for the area north of Congress Street;
- The new Children's Museum and Transportation Museum at Congress and Sleeper Streets;
- Proposed residential and hotel development on the Athanas property north of Northern Avenue;
- The new Federal Reserve Bank;
- The U.S. Post Office expansion of their South Station facility;
- The development of South Station into a major transportation center; and
- The "Walk to the Sea" network of pedestrian paths through Boston and a waterfront pedestrian walkway system.



Aerial view of Fort Point Channel area

Demand for in-town marinas will increase as residents move into the area. Marina space in the vicinity has rented very quickly and Fort Point Channel, being sheltered and navigable, is a potential site for marina development.

The proposed Northern Avenue Bridge replacement scheme should allow for increased Channel usage without causing disruption to traffic flow as occurs with the current bridge when it is opened. The centering pier and fendering system of the present bridge will most likely be retained for recreational and marine use. Bridge piers will be located outside the defined navigable channel.

Further discussions of the characteristics of channel usage are presented in Section III under Channel Navigation-Horizontal Clearance, and Channel Navigation-Vertical Clearance.

Utilities

No change.

Railroads

No change.

Pedestrian Activity

The recommended scheme will provide for pedestrian walkways under the new bridge on both sides of the Fort Point Channel. These walkways will form an important part of a public waterfront pedestrian system along the harbor's edge, as proposed by the City of Boston.

Other Municipal Services

Construction of a new fixed-span bridge over the Channel will provide insufficient vertical clearance for fire boats to service the upper reaches of the Channel. A commitment has been made by the Massachusetts Department of Public Works to the Boston Fire Department to install a new channel perimeter hydrant system as part of the Northern Avenue Bridge project. The new hydrant system will be funded by state and federal sources, and will be in place prior to bridge construction.

Water Quality

No change.

Traffic Circulation

Since the 1974 report, plans for major land development in the Northern Avenue area have become more refined. The 1974 report estimated approximately 70,000 vehicle trips daily could be generated in year 1995 by the proposed land uses for the area, as they were known at that time. The estimate of future trip generation has been revised for this report on the basis of current land use plans for the area.

The trip generation, modal split, and trip distribution assumptions, as contained in the 1974 report, appear valid for the current conditions. These rates were then applied to the present land use assumptions for the Northern Avenue area to obtain the current estimate of trip generation. On the basis of current proposed or assumed land uses, 56,000 daily trips are estimated to originate or end in the Northern Avenue area by year 1995. This new projection is 20 per cent lower than the previous 1974 estimate. However, this estimate of total trips for the area translates to 24,000 vehicle trips daily over the new Northern Avenue Bridge by year 1995. Currently, 17,000 vehicle trips occur daily over the existing bridge. Thus, by 1995, approximately 40 per cent more trips could be expected over the new bridge than under existing conditions.

Also, differences in future trip peaking characteristics between the previously assumed land uses and the updated land uses were examined, and were concluded to be insignificant. Therefore, both peak and off-peak future trip generations (short and long term) are expected to be less than previously estimated for 1995, but still significantly above existing levels.

Air Quality

Based on development plans known at this time, 1995 auto traffic trip generation projections are approximately 20 percent lower than those derived in 1974 (as described in Section 5.10 of the previous report). This reduction in trips reflects a reduction in the scale and density of new development proposed by area land owners.

While the total quantity of traffic may be lower, the quantity of truck traffic is expected to be higher, due to recently announced plans to expand marine-related industrial facilities in South Boston. Massport's plan to build a container handling facility in the Boston Marine Industrial Park will account for the majority of the increase in projected truck traffic.

Without detailed analysis, it is not known to what extent there will be a reduction in the impact on air quality if the projected 1995 average daily traffic volume for the entire area is reduced by approximately 20 percent per day. Improved air quality resulting from a decrease in total traffic volume may be offset somewhat by degradations in air quality caused by increases in truck traffic, with the total emissions projections conceivably remaining approximately the same as had been previously predicted. As stated in previous reports, future air quality generally should improve over existing conditions due to required adherence of all vehicles to future emissions standards.

Noise

The new projection of year 1995 traffic volumes should translate into reduced future noise impacts than those estimated in the 1974 report. However, noise-reduction benefits resulting from reduced total volumes, could be offset somewhat by increased noise occasioned from increased truck traffic. The net effect, however, is anticipated to be equal to or less than that estimated for previous bridge replacement schemes.

Land Use

In the five years since the 1974 report was prepared and the feasibility study was performed, land use and development plans for properties on both sides of Fort Point Channel have become more clearly defined. Most

current proposals are dependent on the availability of a new bridge to provide access between new residential development planned in the Fort Point Channel area and downtown, and between South Boston industries and the regional highway network.

Land owners adjacent to existing Northern Avenue and the right-of-way of the new Northern Avenue in South Boston, propose to undertake extensive building rehabilitation and new development during the next ten years. Their plans are contingent on the availability of a Channel crossing at Northern Avenue. During final design of the new Northern Avenue Bridge replacement, landowners will be consulted and minor modifications to road alignment and design will be made, where possible, to accommodate development plans.

An outline of current development plans follow:

- Johnstown Properties
  Consolidated Capital Properties Corporation, owner
  (Parcel No. 4 on Figure 8)

Part of the property is occupied by an office building, while the remaining portion is undeveloped and will be taken for the construction of the new Northern Avenue Bridge.

- Alfred Hook, et. al., owners
  (Parcel No. 2 on Figure 8)

The Hook Lobster Company occupies this site and is expected to remain. A small land taking is anticipated on the south side of the parcel for the new bridge.

- Anthony Athanas, owner
  (Piers 1 through 4 north of existing Northern Avenue)

Plans call for 1000 units of new market rate housing, a 400-room hotel, a parking garage, and a boat marina. No taking of land is anticipated. Site access will remain from existing Northern Avenue.

- John Daigle, owner
  (Parcel No. 5 on Figure 8)

The Neptune Lobster Company is expected to remain at this location. A small land acquisition will be required on the south end of this parcel for the new bridge. This land may be replaced by portions of existing Sleeper Street which may be abandoned. Vehicle access and parking will be changed somewhat once the new bridge is constructed but will still be adequate.

- Farrell's Dock and Terminal Company, owner
  (Parcel Nos. 6 and 7 on Figure 8)

The McKie Lighter Company occupies a small part of the property, and will be displaced by the new bridge. A replacement site will be found for their relocation. Victoria Station Restaurant occupies the rest of the parcel, and is expected to remain. Vehicle access and parking will be changed once the new bridge is constructed.

- Donald J. Moore, Jr., owner
  (Parcel Nos. 8 and 9 on Figure 8)

This property is bisected by Sleeper Street. The Wolfer Lighting Company occupies a warehouse on the east side of Sleeper Street and is expected to remain. Truck access to the warehouse will be retained. The remaining portion of the property is undeveloped. No land takings are anticipated.

- Penn Central Properties, owners
  (Parcel No. 11 on Figure 8)

The former railyards are under option to Broderick Development Corporation, which plans to develop offices or a trade center on the site. The proposed Northern Avenue relocation will require the taking of a 102-foot wide right-of-way, which will bisect the property.

- Town and City Properties, owner
  (Various buildings between Sleeper Street, Congress Street and Stillings Street)

Town and City Properties own most of the buildings on Farnsworth, Pittsburgh and Stillings Streets, and on the southern side of Sleeper Street. They propose to renovate the buildings for residential use, with some office and commercial uses. No land takings are anticipated.

- Roman Catholic Archdiocese of Boston, owner
  (Parcel No. 10 on Figure 8)

The Chapel of Our Lady of the Good Voyage is expected to remain in its present location. Auto access will be preserved via existing Northern Avenue. A small land-taking is required on the southern end of the property.

Section 4 (f) Lands

The U.S. Department of the Interior has recently determined that the existing Northern Avenue Bridge is eligible for listing on the National Register of

Historic Places. Under the present proposed alternative for the new Northern Avenue Bridge, the existing bridge is not proposed for demolition or modification. The Section 4(f) regulations which govern changes to historic structures have been found not to apply to the construction project proposed for the new Northern Avenue Bridge, because this action will not require any changes to the existing bridge.

It should be noted, however, that although the existing bridge is eligible, it has not been put on the National Register as an historic landmark.

The City of Boston has made a commitment to save the existing bridge. Future uses for the bridge are now under study.

Tax Base

No change.

Employment

No change.

Aesthetics

The new bridge is designed to impose a minimal visual impact on the Channel area. The number of spans is reduced from the previous 5 to 4 in this recommended replacement scheme. The change will necessitate only three piers instead of four, and will reduce the apparent size and mass of the bridge to the viewer.

The bridge structure will be shallow, which in combination with a gentle rise over the Channel and slightly greater clearance above the water, should lend an air of "lightness" to the bridge. Where the bridge touches down on land, the area around the concrete abutments will be landscaped to several feet in height to visually enhance the area.

Recreation

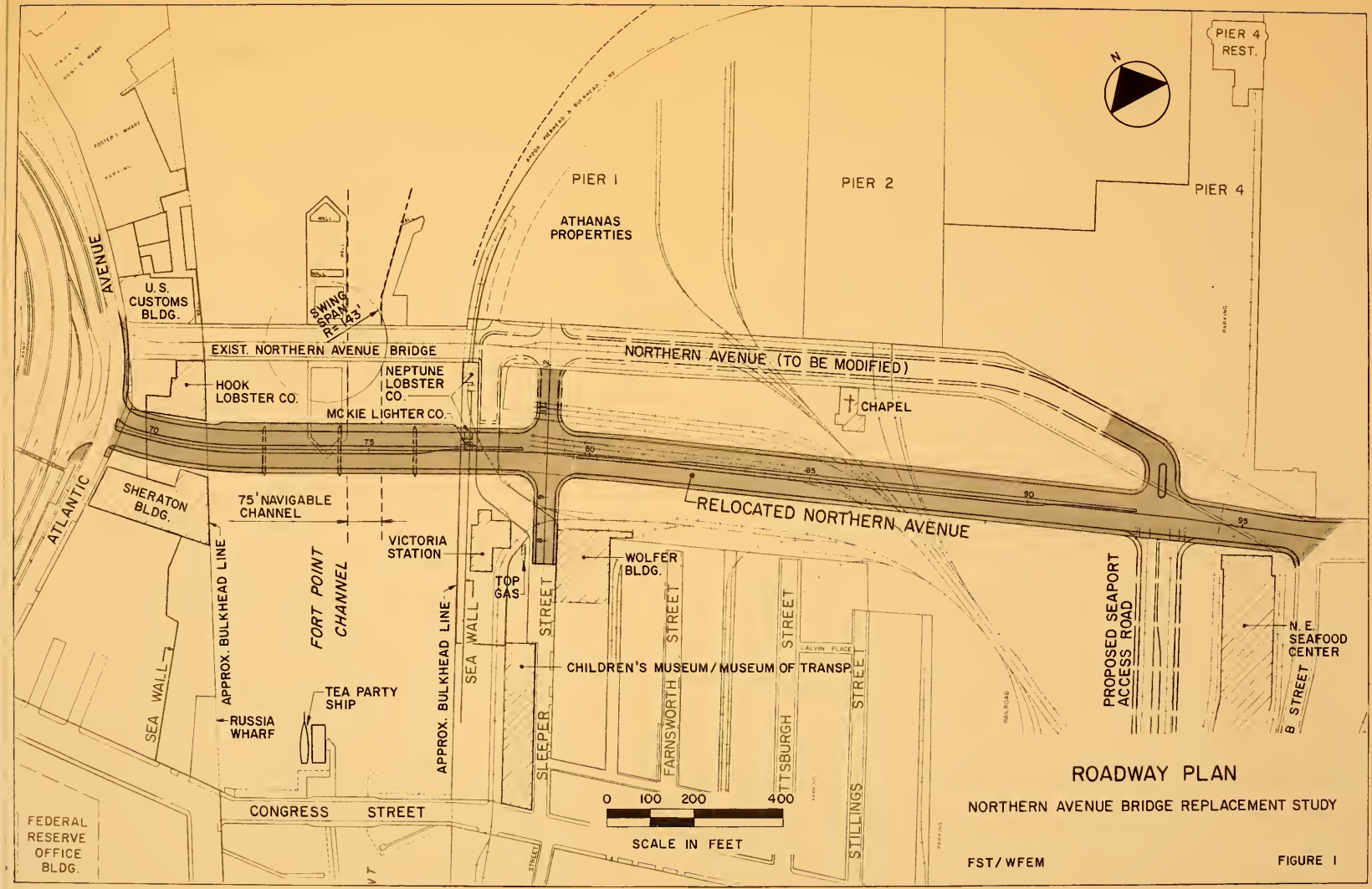
The proposed bridge design will provide sufficient clearance under the structure so that pedestrian walkways can be constructed on both sides of the Channel. The bridge itself will include a 10-foot wide walkway on the south side of the bridge and a 20-foot promenade on the north of the bridge. Provision will be made for a stairway to be built from the promenade down to the centering pier of the existing bridge.

National Defense

No change.

Summary of Long-Term Impacts

There is no significant change in the potential environmental impacts of the proposed Northern Avenue Bridge replacement from those described in the 1974 report. Thus, the previous Negative Declaration appears still valid.

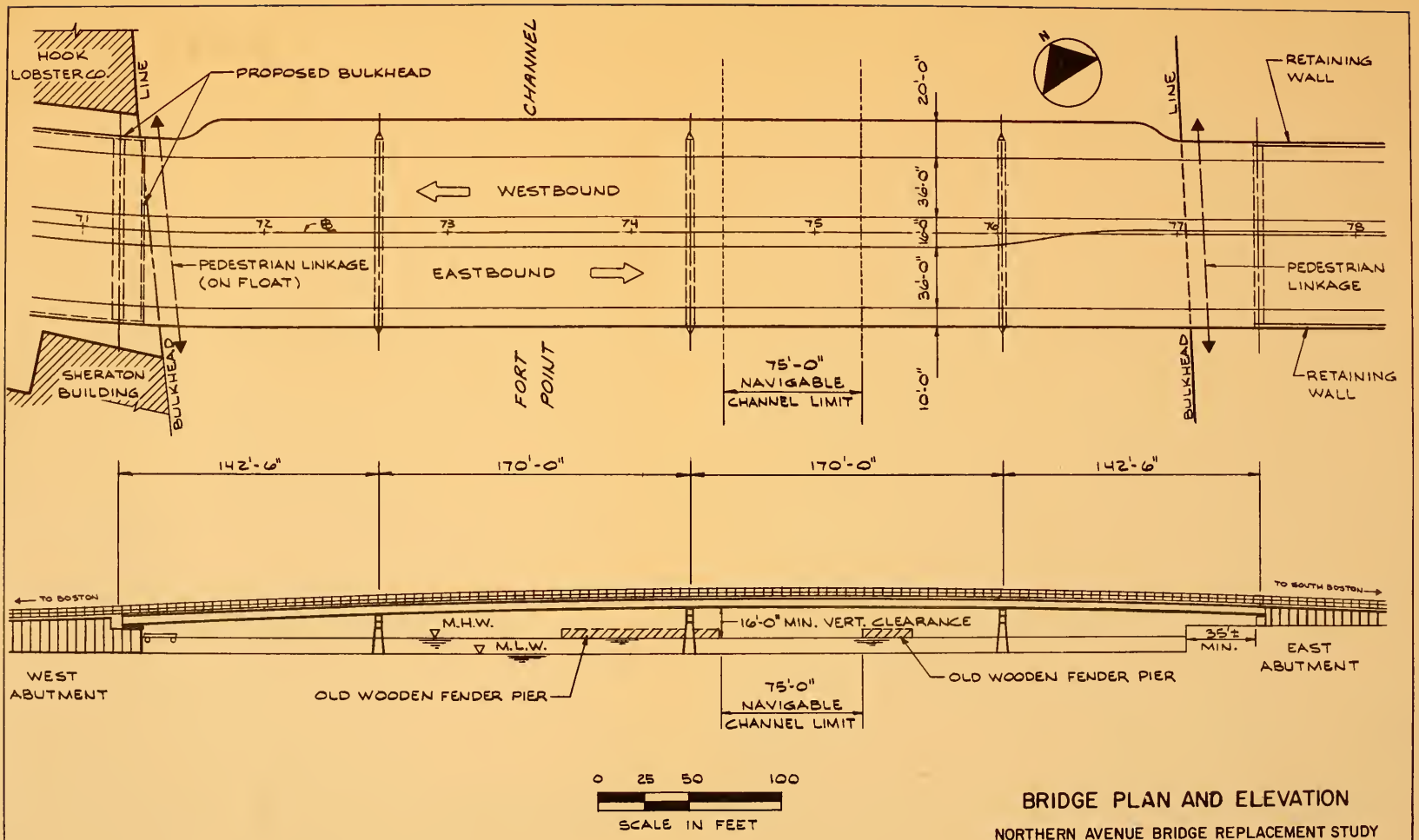


ROADWAY PLAN

NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

FST/WFEM

FIGURE 1

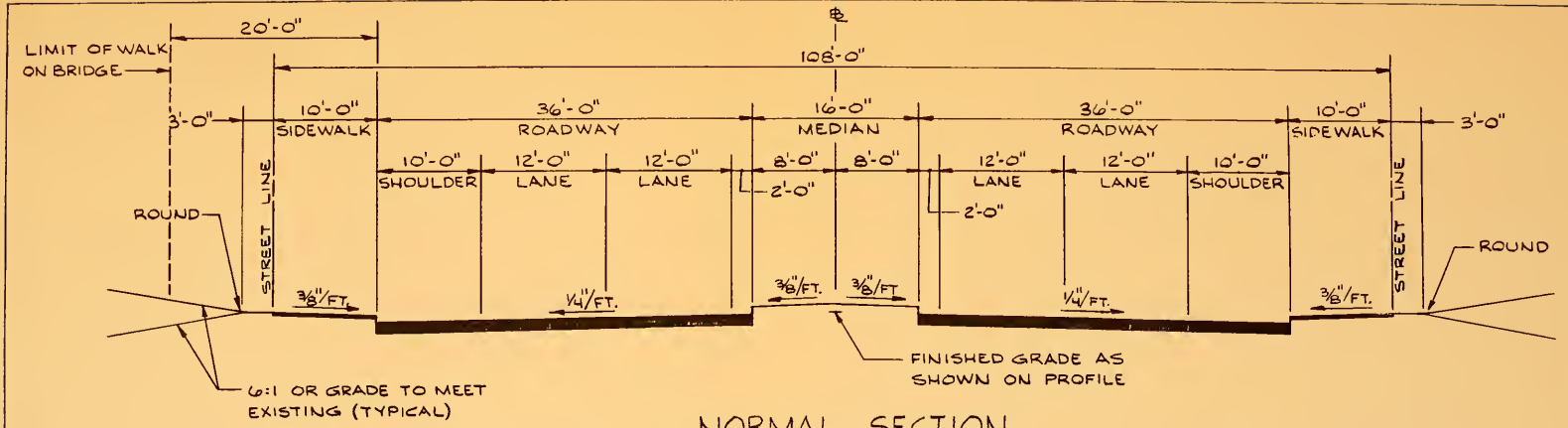


BRIDGE PLAN AND ELEVATION

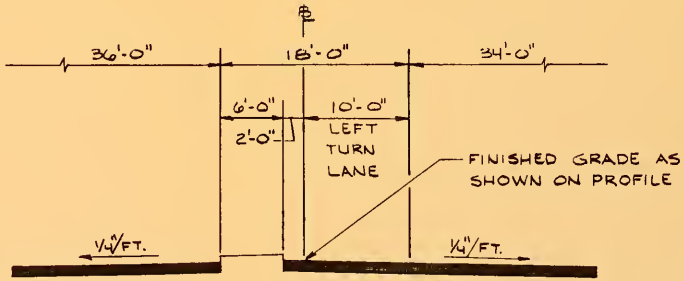
NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

FST/ WFEM

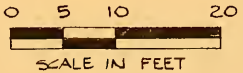
FIGURE 2



NORMAL SECTION



LEFT TURN LANE

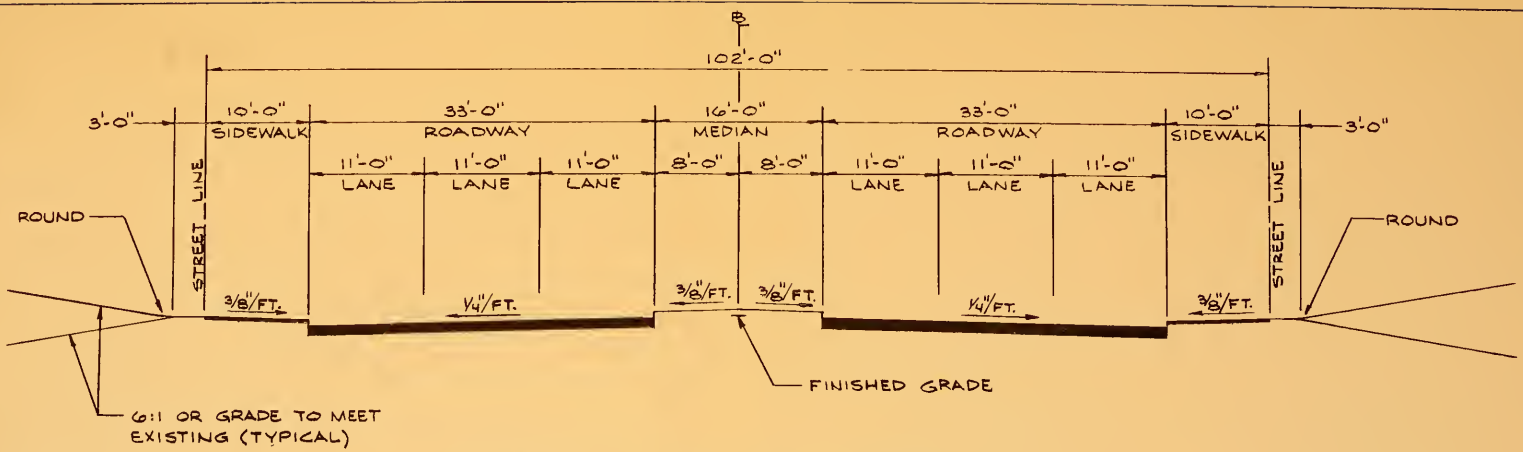


TYPICAL CROSS-SECTIONS
RELOCATED NORTHERN AVENUE

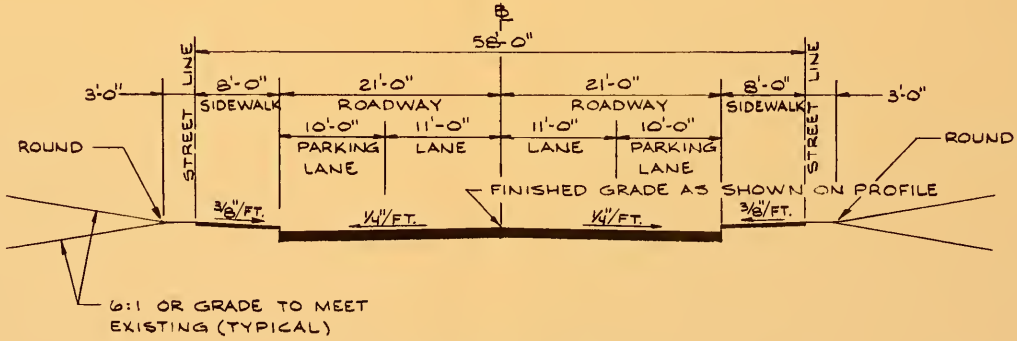
NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

FST/ WFEM

FIGURE 3



SEAPORT ACCESS ROAD



SLEEPER STREET

0 5 10 20

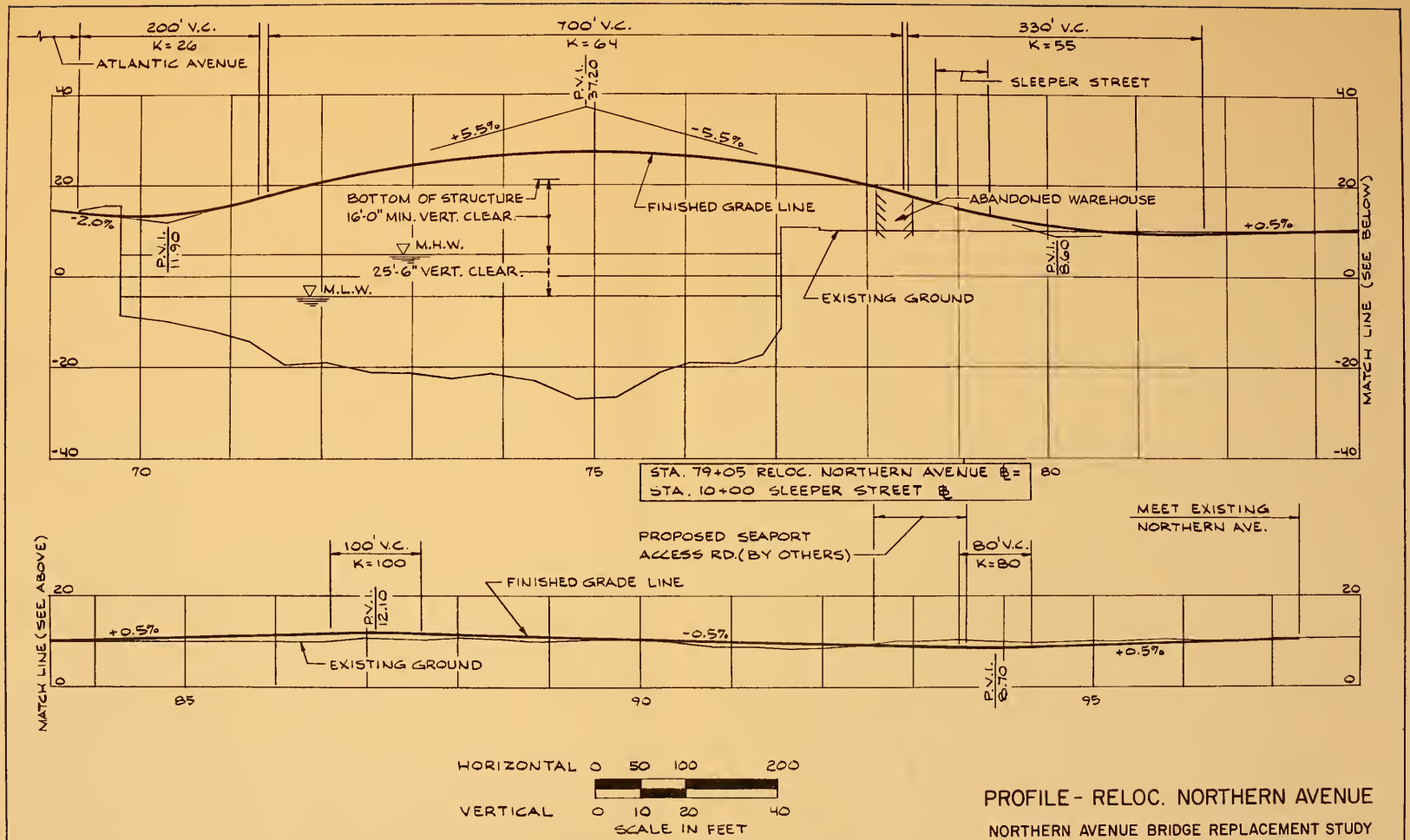
SCALE IN FEET

TYPICAL CROSS-SECTIONS
SEAPORT ACCESS RD. & SLEEPER ST.

NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

FST/ WFEM

FIGURE 4

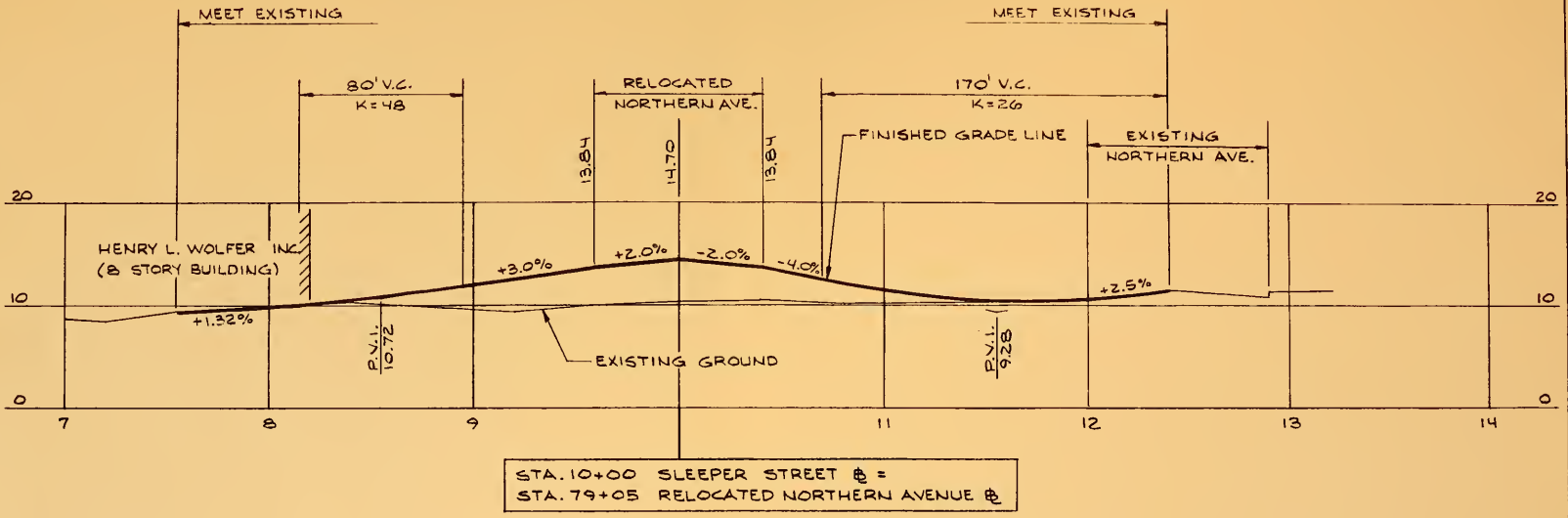


PROFILE - RELOC. NORTHERN AVENUE

NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

FST/WFEM

FIGURE 5



HORIZONTAL 0 25 50 100

VERTICAL 0 5 10 20

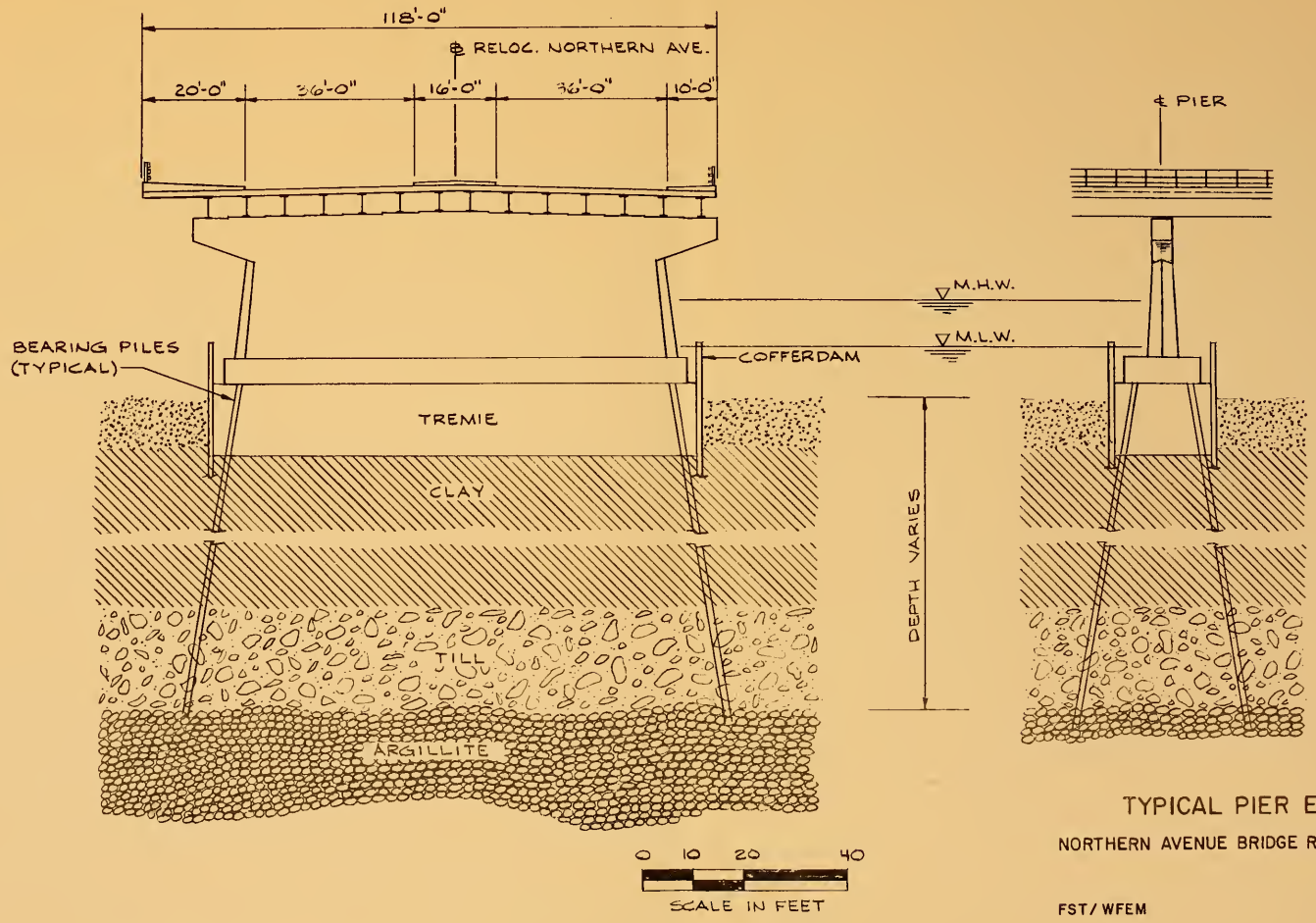
SCALE IN FEET

PROFILE - SLEEPER STREET

NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

FST/WFEM

FIGURE 6

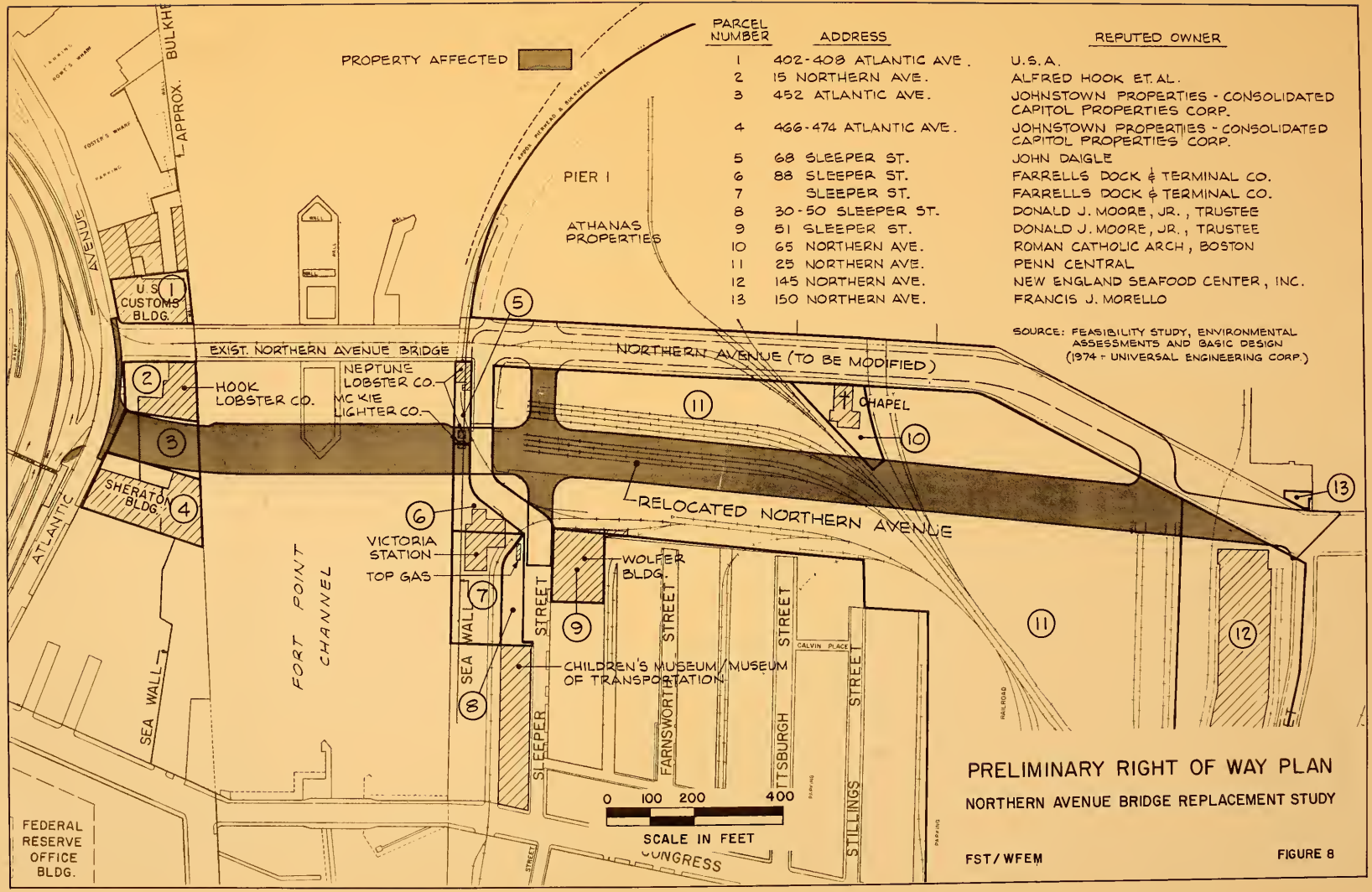


TYPICAL PIER ELEVATION

NORTHERN AVENUE BRIDGE REPLACEMENT STUDY

FST/ WFEM

FIGURE 7


PROPERTY AFFECTED
PARCEL NUMBER
ADDRESS
REPUTED OWNER
1 402-408 ATLANTIC AVE. U.S.A.
2 15 NORTHERN AVE. ALFRED HOOK ET. AL.
3 452 ATLANTIC AVE. JOHNSTOWN PROPERTIES - CONSOLIDATED CAPITOL PROPERTIES CORP.
4 466-474 ATLANTIC AVE. JOHNSTOWN PROPERTIES - CONSOLIDATED CAPITOL PROPERTIES CORP.
5 68 SLEEPER ST. JOHN DAIGLE
6 88 SLEEPER ST. FARRELLS DOCK & TERMINAL CO.
7 SLEEPER ST. FARRELLS DOCK & TERMINAL CO.
8 30-50 SLEEPER ST. DONALD J. MOORE, JR., TRUSTEE
9 51 SLEEPER ST. DONALD J. MOORE, JR., TRUSTEE
10 65 NORTHERN AVE. ROMAN CATHOLIC ARCH, BOSTON
11 25 NORTHERN AVE. PENN CENTRAL
12 145 NORTHERN AVE. NEW ENGLAND SEAFOOD CENTER, INC.
13 150 NORTHERN AVE. FRANCIS J. MORELLO
SOURCE: FEASIBILITY STUDY, ENVIRONMENTAL ASSESSMENTS AND BASIC DESIGN (1974 - UNIVERSAL ENGINEERING CORP.)
PIER I
ATHANAS PROPERTIES
BULKHEAD LINE
APPROX.
ATLANTIC AVENUE
U.S. CUSTOMS BLDG.
EXIST. NORTHERN AVENUE BRIDGE
NORTHERN AVENUE (TO BE MODIFIED)
HOOK LOBSTER CO.
NEPTUNE LOBSTER CO.
MC KIE LIGHTER CO.
CHAPEL
SHERATON BLDG.
RELOCATED NORTHERN AVENUE
VICTORIA STATION
TOP GAS
WOLFER BLDG.
FORT POINT CHANNEL
SEA WALL
SLEEPER STREET
FARNSWORTH STREET
PITTSBURGH STREET
CALVIN PLACE
STILLINGS STREET
CHILDREN'S MUSEUM / MUSEUM OF TRANSPORTATION
RAILROAD
FEDERAL RESERVE OFFICE BLDG.
CONGRESS STREET
0 100 200 400
SCALE IN FEET
PRELIMINARY RIGHT OF WAY PLAN
NORTHERN AVENUE BRIDGE REPLACEMENT STUDY
FST/WFEM
FIGURE 8

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